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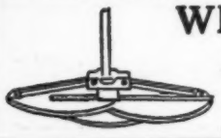

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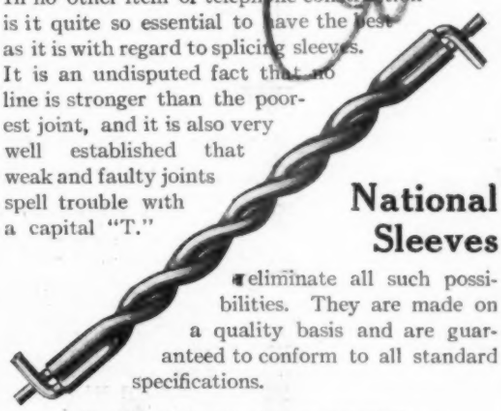

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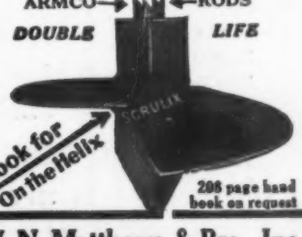

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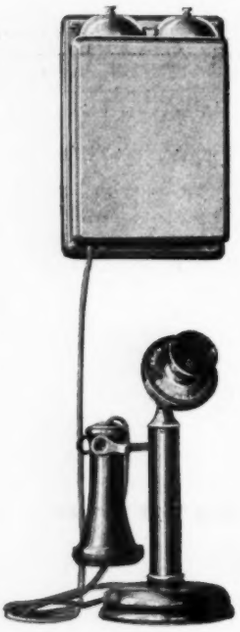

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A Word of Advice.

All Independent telephone companies doubtless welcomed the announcement in last week's issue of TELEPHONY regarding the appointment of the 26 district chairmen, who will locally represent the United States Telegraph & Telephone Administration Operating Board.

As stated by F. B. MacKinnon, chairman of the Independent group, these 26 men, all well known in telephone circles, have been designated to assist in carrying out a systematic method of dealing with Independent interests, and are expected to keep in touch with the properties in their respective districts. They will make it their business to see that tributary companies conform to the regulations incident to the period of government control. What is more, they stand ready to advise and assist any company that may need information or counsel regarding their relation to the federal authorities.

The list of district chairmen quite naturally reads like a list of the directors of the United States Independent Telephone Association, for it was wisely deemed expedient to select men who are prominent in their localities, and that qualification necessarily pointed to the leaders of the association.

Successful operation of this plan means cohesion among Independent telephone men, and cohesion at this time is more important than ever before. They are well represented at Washington, and an organization of district chairmen throughout the country will add to the Independent strength immeasurably. A united policy, supported by the 8,000 Independent units mentioned by Mr. MacKinnon, is sure to make itself felt.

Telephone executives and managers who are in doubt about their course of action during government control, should communicate with their district chairman and follow his instructions and suggestions. This will prevent them from running foul of the Postmaster General's existing rules, and save themselves trouble.

It can not be stated too often or too forcibly that the leaders of the organization feel the great importance of companies keeping their plants in good condition during this transition period. Nothing could be more detrimental to the final determination of the telephone question than to neglect the up-keep of the properties and allow the service to deteriorate. No telephone man who wants his property returned to him when the peace treaties are ratified, will advance his interests by letting his equipment and organization run down to heel. The contrary is true. What better argument can be presented against government ownership than the proof that maintenance and service have been continued in first class shape, and that the properties are ready to go back to the private owners and serve the public efficiently?

The next few weeks will decide what the present congress does with regard to the Moon resolution concerning wire communication. Meantime, while government control continues, operating companies should conform to the Postmaster General's regulations, keep in close touch with their district chairman, and see that their plants are kept in first class shape.

Years ago the fable of the bundle of sticks was related to demonstrate the saying, "In union there is strength." For nearly four years the Allies separately fought the Hun but the results were by no means effective. It was only when the armies were united under the supreme command of General Foch, that the tide of the war changed.

Again it was demonstrated that united leadership is certain to develop strength and carry through critical times safely.

The telephone industry is passing through critical times. United leadership is essential—and following it will carry us safely through whatever may happen in the months to come. The Bell companies are following a united leadership—and it is highly essential that the Independents, for their own protection, do likewise.

The United States Independent Telephone Association, under the guidance of F. B. MacKinnon, has developed the organization for a united leadership of the Independent companies. The leadership should be followed through the critical period we are now passing, and in "Union there is strength" will again be found true.

The Diagonal Resistance Chart

Method of Constructing a Diagonal Resistance Chart or Map and Its Use in Simplifying the Making of Trouble Measurements and their Locations—Use of Chart as a Calculator or Slide Rule—Illustrations of Uses

By A E Burns

The resistance chart described in this article was worked out under practical conditions with the purpose of making ordinary trouble measurements and locations as simple as possible. In this it has proved itself very useful and efficient, and it is with the hope that it may be of like value to others that I attempt its description.

The chart itself can be made as elaborate as individual taste or judgment may dictate. It can be elaborated into a complete traffic map, or can be made to indicate the topographical features of the adjacent country, such as woods, swamps, roads, etc., but the experience of the writer would indicate that, for simplicity's sake, it should be used merely as a resistance record, the geographical features being regarded as reference points only.

Once drawn, the use of it becomes almost purely mechanical, eliminating all chance of those arithmetical errors which we all are apt to make, especially when under strain.

When it is considered that the times of stress are precisely the times when mistakes are most disastrous, it would seem that a device of this kind might prove invaluable.

Several charts of the kind that the writer has developed have been used by a number of different linemen of average ability, and by two different chief operators. All learned to make ordinary trouble locations with ease, although few had more than a vague idea of what an ohm is, and none probably ever heard of a temperature co-efficient.

It may be said to bear somewhat the same relation to figuring with pencil and paper that the elaborate equipment of a modern wire chief's desk has to the old laboratory tests where a maze of wire strung around the room served all requirements.

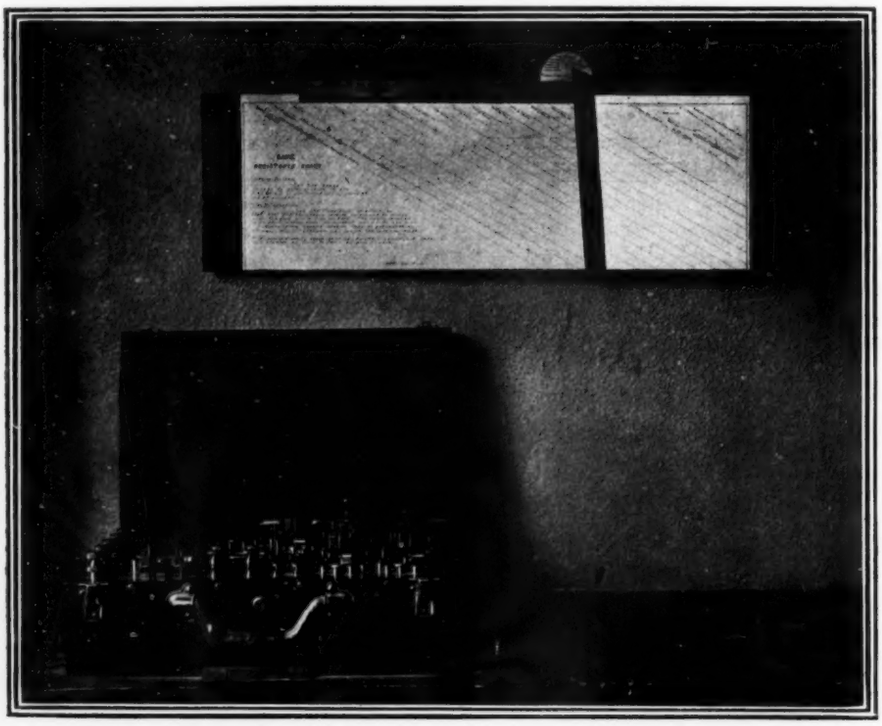


Fig. 1. Resistance Chart on Wall Convenient to Wheatstone Bridge.

While it is very desirable to be able to work out such problems from first principles, if need be, to insure a proper understanding of basic facts, there is no particular virtue in repeating the operation thereafter any more than there would be in deriving a table of logarithms each time a slide rule is used.

The chart itself should be long enough to hold the number of lines subject to test, and wide enough to cover the resistance range of the longest line. Outside of this, the dimensions are not essential and will be determined by local conditions.

In its essentials, the device consists of:

1. A chart or map drawn to scale and representing line resistances under normal conditions.
2. A sliding scale, or index, for measuring these resistances.
3. An adjustable pointer, or straight-edge, for localizing these measurements.

Construction of Chart.

The Chart: Fig. 1 shows one of these charts mounted on the wall convenient to the Wheatstone bridge. This particular chart is about 12 ins. by 36 ins. and will carry 15 to 20 lines.

A piece of ½-inch veneer would be ideal for the support, but any good wood will do. In the one illustrated a piece of ½-inch cedar is used and it serves admirably.

The top edge must be dressed down to an accurate straight-edge and any pains taken to insure this will be well repaid.

In Fig. 2 is shown the method of mounting it on the wall. The cleats between the chart and the wall serve the double purpose of setting the slider away from the wall far enough to give hand room and also of preventing the warping of the chart board. These cleats should be glued to the back of the board and secured with small screws before the paper is fastened to the surface.

The Paper: Procure a sheet of good white drawing paper of a fairly smooth surface. Do not use the calendered paper, however, as it should be able to stand a good deal of erasing.

Cut a piece of this the size of the board and lay it face down on a clean newspaper. Take a damp cloth, or sponge, and thoroughly moisten the back until it lies limp on the table. Then spread a thin coat of liquid glue over the entire back with the fingers—the best glue brush made. As soon as this is covered smoothly, moisten the surface of the board slightly with the damp sponge but not enough for any water to stand on the surface.

Wash and dry the hands and then lay the paper in place. Rub it down with a dry cloth, using small circular strokes beginning at the center and working outward. It will be well to screw the board down until the paper dries thoroughly, as it exerts a powerful pull that might warp the board.

The Sliding Scale: The slider should be made of a piece of hardwood of the same thickness as the chart board and

about 2½ inches or 3 inches wide. The length will depend upon the range of resistance to be covered. Using a scale of ⅛ inch = 10 ohms, a 15-inch scale will cover 1,000 ohms, an inch or two more being allowed for the pointer.

The bottom edge should be dressed to a straight edge as in the chart boards, with the same pains to insure accuracy. As a matter of fact, however, any small errors will not affect results to any extent, as the chart is calibrated in place and any errors are corrected in the calibration.

The Scale of Ohms: The scale of ohms may be made of some hard, close-grained wood. An old ruler, or yard stick, dressed down is ideal. The lower edge should be dressed to a sharp bevel so there will be no error in reading due to parallax. Cover it with a thin solution of shellac and wipe dry instantly before it has time to become sticky; then set it aside to dry. This is a sizing to keep the ink from running.

It may be possible to procure a ruler of the right shape and merely rub out the inch figures and substitute the markings shown in Fig. 2. With a little care, however, the divisions may be made very accurately by hand. Make them lightly with a sharp pencil first and then ink in with Higgins' drawing ink, using a fine ruling pen. When dry, give another coat of shellac for protection. This scale is then fastened to the slider with small wood screws as shown in Fig. 2.

The Pointer: The pointer is made of a thin strip of brass about one inch wide. The brass liners used by printers are just the thing for this as they already have one edge beveled and are perfectly straight.

This is cut to the shape shown in Fig. 2 and a small hole drilled as near the edge as possible, for the pivot. A slot is cut on about a one-inch radius from the pivot to allow the locking screw to project. The pivot lug is formed of a similar piece of brass that is attached to the slider with small screws, and the hole for the pivot is bored through both pointer and lug exactly on a level with the lower edge of the scale of ohms.

If a 2/56 machine screw tap is available, thread the pivot lug and screw a 2/56 round head screw in for a pivot, and dress the bottom surface smooth with a file. Lacking this, use a brass escutcheon pin, countersink the bottom hole slightly from the rear and solder to the back of the pivot lug, dressing down smooth as has just been described.

Temperature Index: Glue a small piece of drawing paper to the slider for the "temperature index." Draw an arc of a circle on it with the top arm of the pointer as a radius and the pivot as a center. The method of calibrating this will be explained later.

Lock Nut: An 8/32 screw from an old dry cell is screwed through the slider, the front projecting through the slot in the pointer. The hole in the slider should be a snug fit to hold the screw from turning when the locknut is tightened. An old battery terminal makes a good thumb nut.

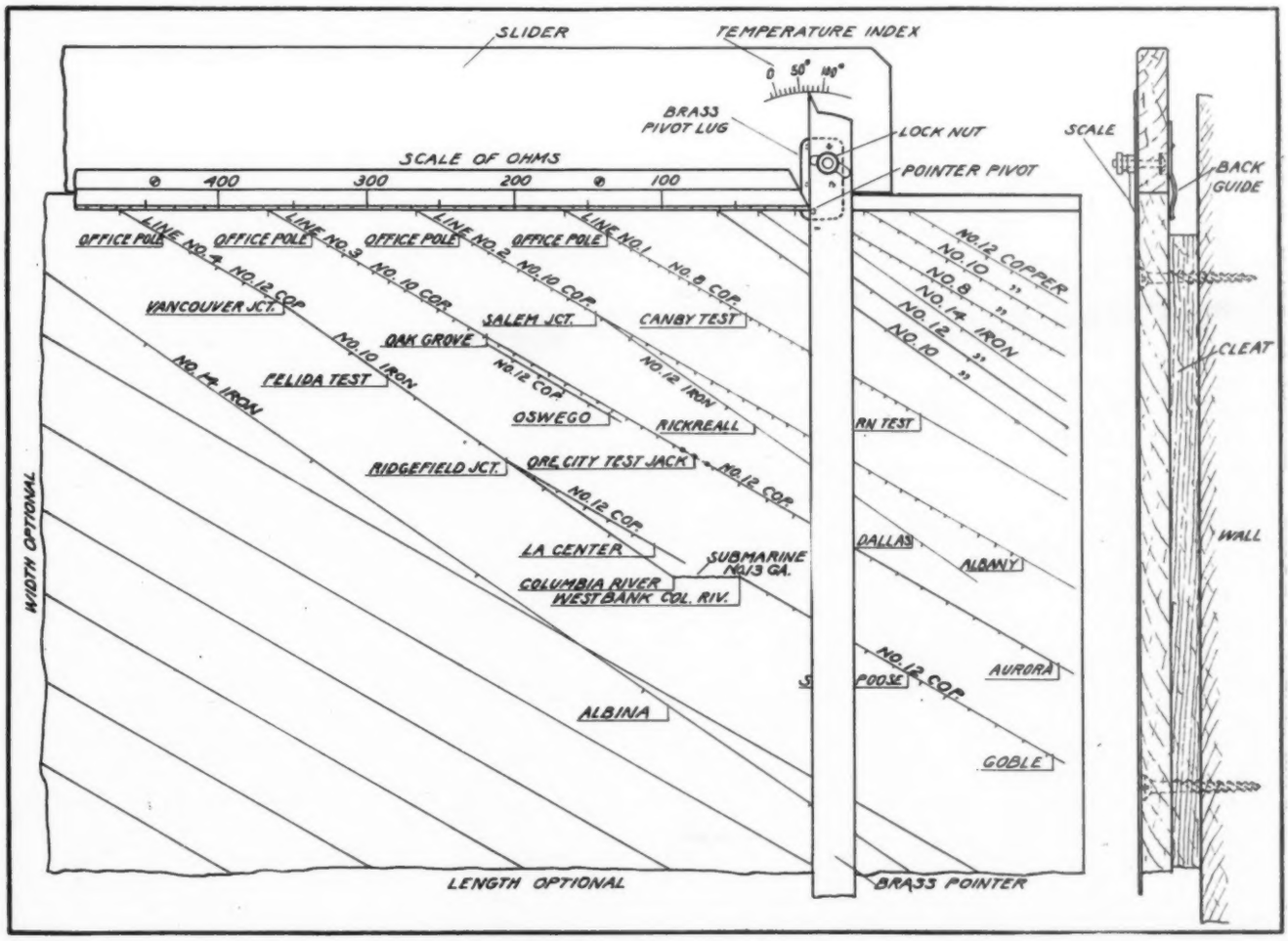


Fig 2. Method of Mounting Resistance Chart on Wall and Details of Scale.

Fig. 3 presents a larger view of the details of the pointer and its associated parts.

Back Guide: To keep the slider from running off the top of the chart, two back guides of spring brass are attached which keep just enough pressure on the slider to insure its running true.

Drawing the Chart: The slope for copper is arbitrary, but 30° is convenient, as a 30° triangle is usually at hand for drawing them; also it is not too oblique an angle for accurate reading.

A number of these lines, 100 ohms apart, are to be drawn with a hard pencil

as a preliminary to plotting the resistance data.

Calibrating Temperature Index: Referring to Fig. 4, proceed as follows:

1. Set pointer perpendicular to scale of ohms and mark position of upper arm arbitrarily. (70° is convenient.)
2. Set 1091 ohms (corresponding to 70° in the table, Fig. 4) on the sliding scale to the base of the 30° line.
3. Mark intersection, *P*, of line and pointer.
4. Set scale to 1,115 ohms. (Resistance at 80°.)
5. Adjust pointer to again intersect the line at *P*.
6. Mark new position of pointer on Temperature Index as 80°.
7. Proceed in same manner for 90°, etc., using values in the table, Fig. 4.

Principle of Operation: The fundamental principle of the whole device rests on the theorem in geometry: "In similar triangles, the homologous sides are proportional."

We have calibrated the temperature index to indicate truly, at all temperatures, the value of a certain copper wire which measures 1,091 ohms at 70°. It remains to be proved that this calibration holds true for any other value of the copper wire resistance, provided the corresponding temperature is known.

Suppose, for simplicity, we take a wire whose resistance is 545½ ohms at 70°. 545½ ohms or *O B*, Fig. 4, is just ½ of 1,091 ohms, or *O A*. Consequently, since the triangles *O B P'* and *O A P* in Fig. 4-A are similar, the side *O P'* is likewise ½ of the side *O P*.

Conversely in Fig. 4-*B*, since the triangle *O B' P'* and *O A' P* are similar and we just found that *O P'* = O P /2, it follows that the side *O B'* = *O A'* /2. By construction, *O A'* = 1,115 ohms, so *O B'* must equal 1115/2 or 557½ ohms, which is correct. This reasoning holds true for any value of *O B* and, consequently, for the entire chart.

Slope for Iron Wire: The foregoing calibration holds true for copper wire which has a temperature co-efficient of .0023.

Iron, however, has a temperature co-efficient of 0.0028, so a wire which has a resistance of 1,091 ohms at 70° would measure 1,120 ohms at 80°, whereas the pointer would only indicate 1,115 ohms. To circumvent this, we draw the slope for iron wire at 35° 6′, which makes the proportional change enough greater to hold true for iron.

The method of arriving at this value is shown in Fig. 5.

Assume two resistances, one of copper and one of iron, which measure 100 ohms at some given temperature. For a hypothetical rise of 1,000°, the copper would increase to 123 ohms and the iron to 128 ohms. This is not strictly true but the proportion holds. The construction follows:

1. Draw perpendicular line *A B* from a point on scale 100 ohms from base of line *O*.
2. Draw line *C B* from *B* to a point 123 ohms from *O*. This represents the pointer setting for copper.
3. Since this same setting of the pointer is to serve for iron wire as well, a line drawn parallel to *B C* through point *C'*, 128 ohms from *O*, will intersect line *A B* at the point *B'* which must be on the line of correct slope for iron wire.

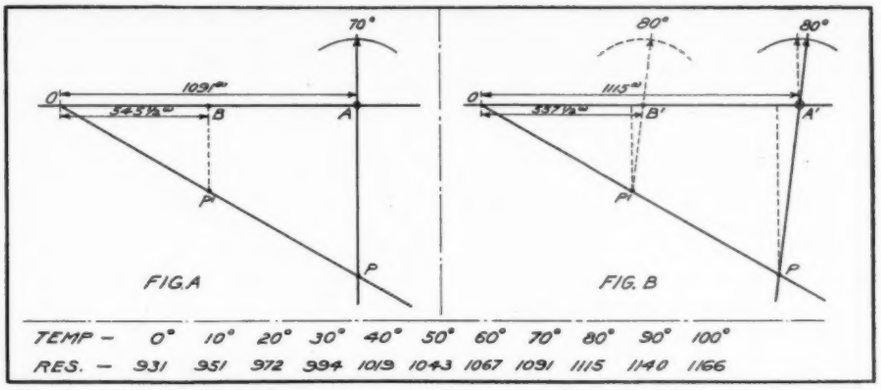


Fig. 4. Method of Calibrating Temperature Index.

4. Draw the *required* line *O B'* through this intersection.

This holds true for any slope that is arbitrarily assigned to copper wire.

By trigonometry, tan. *O A B* / tan. *O A B'* = 23/28, since *A C B* and *A C' B'* are similar.

If we assign $<O\ A\ B = 30°$, this becomes:

$$.5774 / \text{tan. } O\ A\ B' = 23/28$$

$$\text{or tan. } O\ A\ B' = .7029.$$

Referring to a trigonometric table, we find .7029 is the tan. of 35° 6′ which is the required angle for iron wire.

Constant Resistance: Occasionally we have a resistance element that is affected little or none by change of temperature, an instance of which is shown in Fig. 2, line No. 4, where a section of submarine cable is encountered. If this runs under salt water, its temperature may be practically regarded as constant.

Plot this section horizontally and it will always subtend the same resistance on the ohms' scale, regardless of the position of the pointer. Where there is any great variation in summer and winter temperatures as in an underground cable, it might be better to mark two values for all points beyond—one for summer and one for winter.

If there was any definite relation between the external and submarine temperatures, it might be possible to plot a multiple chart to take care of this, but lacking data, this variation will have to be eliminated arithmetically for each case, or else ignored if not too great.

The Line Chart: Fig. 2 shows a portion of a hypothetical chart. It may be well to state that these are not actual lines, but, as the poet says, "it might have been."

Mileage: The small dots beneath the lines, Fig. 2, indicate mileage and the scale naturally varies with the gauge of wire. The legend in the upper right hand corner indicates the scale for several commonly-used sizes of wire.

Following is a short explanation of the lines as they appear on the chart:

Line No. 1. No. 8 copper, no branches.

Line No. 2. No. 10 copper with a branch line of No 12 iron.

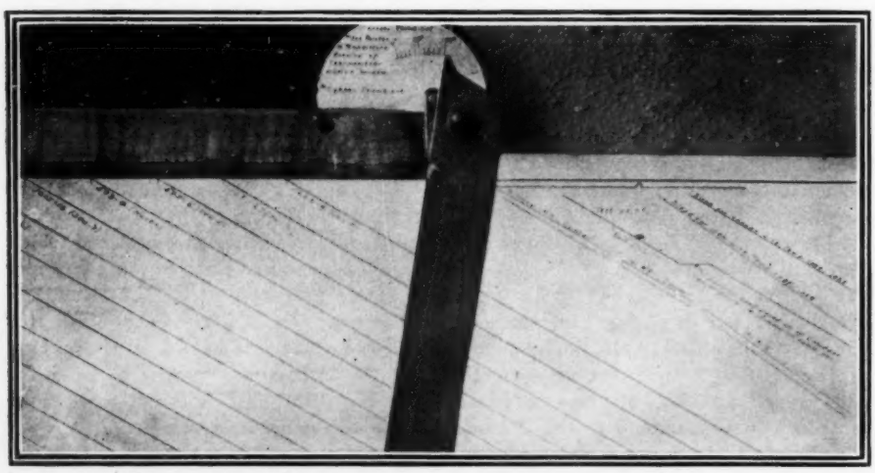


Fig. 3. Pointer of Resistance Chart and Its Associated Parts.

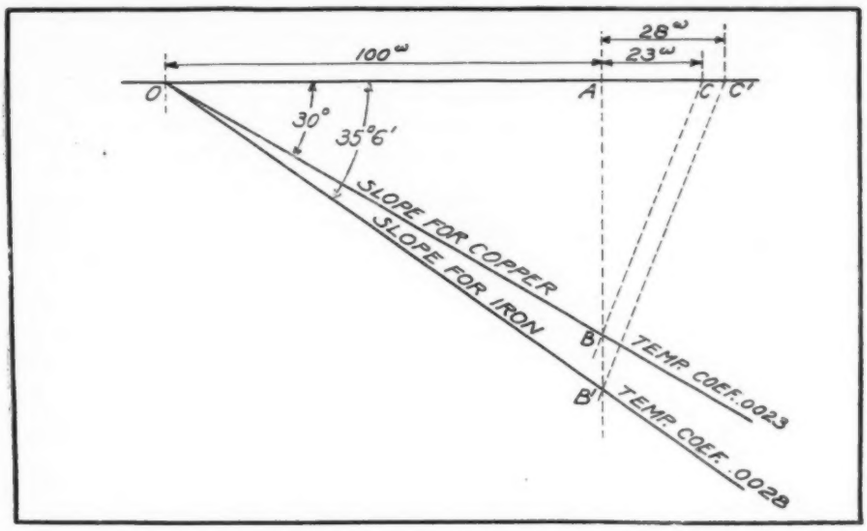


Fig. 5. Method of Finding Correct Slope for Iron Wire.

Line No. 3. No. 10 copper with a branch line of No. 10 copper.

Line No. 4. Starts No. 10 copper, takes No. 10 iron (through timber, for instance), has a branch line of No. 12 copper, crosses a large river in submarine, and then takes No. 12 copper the remainder of its length.

Line No. 5. No. 14 iron.

Transmission: Incidentally the length of lines in the chart serve as a fairly accurate transmission chart, since under similar construction methods, the transmission loss varies nearly as the resistance.

Plotting Line Points: A concrete example, Fig. 6, will best illustrate this:

A test to Albany on a cool morning measures 382 ohms; temperature is 45°. The procedure is as follows:

1. Set pointer to 45°.
2. Set scale 382 ohms.
3. Mark intersection of pointer and line as "Albany."

These markings had better be made in pencil to allow for future changes.

Use of Chart: The use of the chart is absurdly simple.

1. Set pointer to temperature of air.
2. Set resistance reading on scale to base of line.
3. Location of trouble is where pointer crosses line.

Temperature Readings: The simplest means of measuring temperature is, of course, a thermometer outside the window where it can easily be read, but often there is no place available to mount one. Reflection of walls or windows or shade trees also may render the readings valueless.

A simple means of circumventing this is shown in Fig. 7 and consists of a magnet coil mounted out in the open air in a weatherproof case. Experience has shown that this should be protected from the direct rays of the sun and should be open on the shady side and bottom, to allow free circulation of air. When mounted in this manner, it has enough temperature inertia to keep it from following momentary local flashes of sunshine and gives a true measure of the mean temperature of the air.

The resistance is optional, but if it can be adjusted to measure 1,000 ohms at 70°, including leading-in wires, its use is made more convenient. But whatever the resistance, its value at any temperature will be proportional to those given in the table, Fig. 4, which is based on 1,000 ohms at 32° Fahr.

The values, when determined, may be platted on the under side of the temperature index.

Anyone interested in the use of thermometric coils will find Dr. Northrup's "Methods of Measuring Electrical Resistance" of much interest.

Use as Slide Rule: It may be of interest to note that the diagonal chart may be used as a calculator or slide rule. It may even be said to have some advantages over the logarithmetic slide rule inasmuch as the percentage of accuracy increases with the size of the numbers involved. A few examples will illustrate:

Multiplication:

Required $1.76 \times 2.01 = X$

Transposing $1.76 = \frac{X}{201}$

or $\frac{1.76}{1} = \frac{X}{201}$

This is in the form of a proportion and can be solved by the use of similar triangles.

Referring to Fig. 8, set the pointer to 1.76 on A and to 1 on B. Then without changing adjustment, set to 2.01 on B and read answer—3.54 on A.

Division:

Problem $251 \div 176 = X$

Amplifying $\frac{251}{176} = \frac{X}{1}$

Set pointer to 251, scale A and 176, scale B. Then set to 1 on scale B and read the answer, 1.42, on scale A.

Square Root:

Required $\sqrt{3.65} = X$

$X^2 = 3.65$

$X : X = 3.65$

or $X/1 = 3.65$

$\frac{}{X}$

Set pointer by trial until setting to 1 on scale B reads the same as scale A as setting to 3.65 on scale A reads on scale B. That is, set 1 on scale B reads 1.91 on

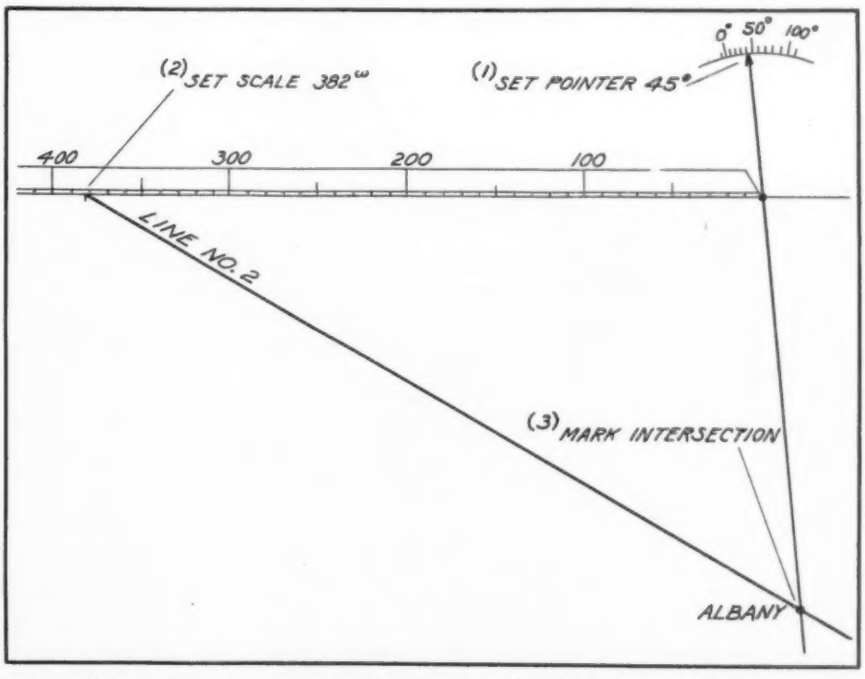


Fig. 6. Method of Platting Line Points—Example Presented, "Albany, 382w, Temp. 45°."

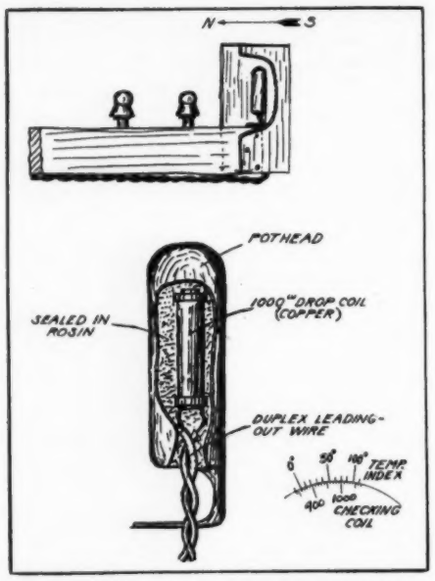


Fig. 7. Resistance Coil for Checking Temperature Correction for Copper Line Wire.

scale A and setting 3.65 on scale A reads 1.91 on scale B. Therefore $\sqrt{3.65} = 1.91$.

Conclusion: This covers the essential features on the "Diagonal Resistance Chart." Anyone who will take the trouble to construct one, will find that it serves all purposes of the ordinary map; that it will calculate practically anything that can be figured with pencil and paper; and not the least important feature, that it will never forget some vital fact in time of stress.

Minnesota Convention Promises to Be a Record-Breaker.

All present indications point to a record-breaking attendance at the tenth annual convention of the Minnesota Independent Telephone Association, to be held at the Ryan Hotel, St. Paul, January 21, 22 and 23.

From the largest to the smallest company comes the same inquiry as to their present relationship with the government and for how long such relationship will continue without knowing more definitely just how to conduct their business.

The officers of the association are endeavoring to secure speakers for the convention who are well versed with the situation and will tell the companies what they may expect under government operation, and in the way of compensation for the use of their properties while under such control.

Dr. David Friday, the compensation expert of the United States Telegraph & Telephone Administration, will be at the convention. In addition to speaking on this question, Dr. Friday will assist the different companies in the way of explanation as to what compensation they may expect to receive.

Guy H. Pratt, of Omaha, Neb., general commercial superintendent of the Northwestern group of Bell companies, will discuss the commercial or business end of the organization.

Capt. W. S. Vivian, secretary of the United States Independent Telephone Association, who has just returned from France after serving with the Signal Corps for about a year, will tell something of the work of the Signal Corps.

Commissioner F. W. Putnam, of the Minnesota Railroad & Warehouse Commission, will speak on the question of co-operation between the commission and the association.

Stanley R. Edwards, of Chicago, editor of TELEPHONY, will discuss pertinent questions of the day.

G. W. Robinson, president of the Tri-State Telephone & Telegrah Co. and of the United States Independent Telephone Association, will present some very interesting and first-hand information as to the relationship between Washington and the Minnesota companies.

It is also planned to have speakers who will discuss the present material and labor situation.

Miss Margaret E. Brice, traffic supervisor of the Tri-State Telephone & Telegraph Co., will discuss the relationship between the manager and the operator.

In addition to the speakers mentioned, there will be several others to discuss subjects of interest to the telephone man, including H. W. Kavel, accounting director of the Dunwoody Institute, who will outline the telephone extension course, given without cost to practical business men in Minnesota.

In connection with the convention there will be held an operators' school, under the personal supervision of Miss Mamie C. Dixon, of Minneapolis, school instructress of the Northwestern Telephone Exchange Co., and Miss Margaret E. Brice, traffic supervisor of the Tri-State Telephone & Telegraph Co. A school session will be held each day of the convention, and it is hoped that the managers will arrange to have as many of their operators as possible attend for the three days, as instruction will be given from a practical standpoint only, and will fit in with local as well as long-distance operating.

As usual, there will be plenty of entertainment for everybody, including a big banquet and dancing party. In addition, special entertainment will be provided for the operators and other ladies attending. In connection with the banquet, arrangements are under way to have Governor J. A. A. Burnquist attend and deliver an address.

More reservations for exhibits at the convention have been made this year than ever before by the manufacturers and jobbers, and the visitors can be assured of seeing the very latest and best of everything pertaining to telephony.

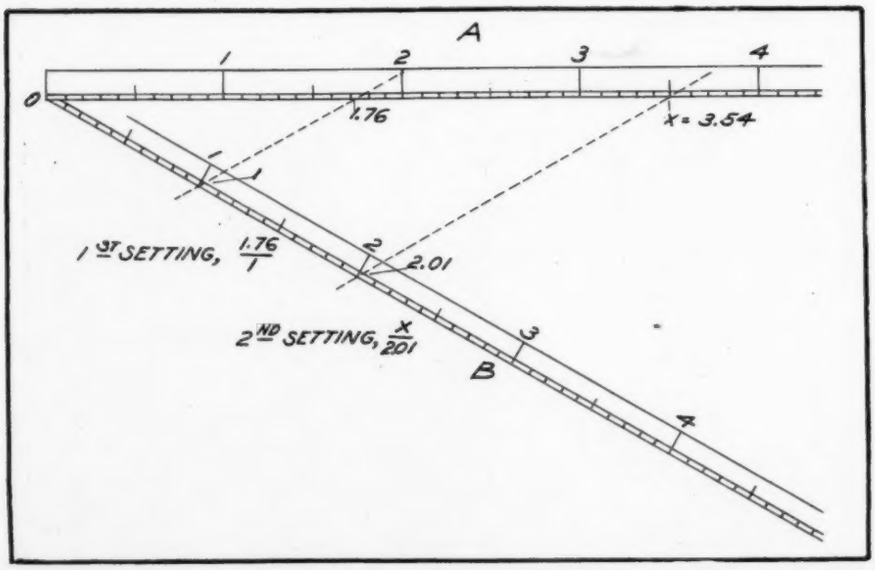


Fig. 8. Special Form of Diagonal Chart Showing How It May Be Used as a Slide-Rule or Calculator.

Ohio Annual Convention to Be Held in February.

At a meeting of the board of directors of the Ohio Independent Telephone Association, held at Columbus, Ohio, on January 2, it was determined to hold the state convention at the Hartman Hotel, Columbus, Ohio, on Wednesday and Thursday, February 5 and 6.

A cordial invitation is extended to all Independent telephone companies, manufacturers and dealers.

Meredosia, Ill., Telephone Exchange Has New Owner.

George VanGundy, of Bluffs, Ill., has purchased the exchange of the Farmers & Merchants Telephone Co., in Meredosia, Ill., and incorporated it under the name of the Home Telephone Co. A number of improvements are being made to the system under direction of Wm. Lowe, local manager.

Fundamental Principles of the Telephone Business

A Reading Course Designed to Present Logically the Principles Which Underlie Successful Organization and Operation of Telephone Properties—Prepared Under the General Supervision of Stanley R. Edwards—This Section, "Part VII, Telephone Engineering Economics," Written by Chas. W. McKay

Editor's Introduction.

Several years ago TELEPHONY's editors recognized the need in the telephone field for a systematic presentation of the fundamental principles of the telephone business. Two reading courses were developed, one under the heading of "TELEPHONY's Home Study Course for Telephone Men," which is prepared for plant and operating men, while the other, "Fundamental Principles of the Telephone Business," was designed primarily for those engaged in the business and commercial side of the industry.

In this latter course, six parts have been published, relating to "The Economics of Telephony," "The Corporate Telephone Organization," "Telephone Accounting and Auditing," "Telephone Finance," "Telephone Advertising and Publicity" and "The Valuation of Telephone Properties."

Another part of this reading course is inaugurated in this week's issue of TELEPHONY under the heading of "Telephone Engineering Economics."

There are certain fundamental facts relating to the engineering of telephone properties which are readily comprehended by the executives of telephone companies and applied in forming judgments on the various questions relating to extensions, development and expansion of their properties. The understanding and application of these economic factors will enable those who are in the business end of the industry and working toward executive positions, to obtain advancement as opportunity offers.

It is necessary for every executive to have a broad grasp of the underlying principles of business and to know their application to his own particular line. This is an age of efficiency—and wastefulness and the "junk" pile are being eliminated. Just as in the case of the pork-packing industry and the famous "squeal" of the pig, the telephone industry will be developed to a high degree of efficiency, operations being performed and everything used in the most economical way.

It is with the intention of presenting the economical engineering factors which have been developed in the telephone field, that this part of the "Fundamental Principles of the Telephone Business" is presented. Its author is Chas. W. McKay, who needs no introduction to TELEPHONY's readers.

Mr. McKay has had extensive experience in the various phases of telephone engineering for the past 12 years. He has been connected in engineering capacities with operating telephone companies and associated with prominent consulting engineers. At present Mr. McKay is appraisal manager for the industrial engineering firm of Cooley & Marvin Co.

CHAPTER I. Introduction.

1. *The World War and industry.*—For several years there has been but one topic of all-absorbing interest—the World War. If one would discuss other subjects, he must needs view them from the war angle—if he would hold the attention of his readers.

Charles W. McKay, Author of New Series of Articles.

This thought, at any rate, may suggest itself to the reader of the technical press, in view of the large amount of space devoted to war subjects. The reader may even wonder, if he is inclined to be analytical, if this is not a species of camouflage on the part of the technical writer to attract attention to his work.

A little reflection, however, will convince even the most skeptical that all modern industry—and certainly every branch of engineering—has been vitally affected by the war. The telephone man has been especially hard hit. Operating and maintenance problems have assumed gigantic proportions. Government control has created new limitations and introduced new responsibilities. But perhaps the most perplexing problem is that of properly engineering the plant to meet new requirements.

The term "engineering" is here used in its broadest sense. A brief review of the real meaning of the term, and of its application to the telephone field, may prove of value as a preface to this series of articles.

2. *Engineering in history.*—The art of engineering is by no means a new one. Long before the invention of the telephone many branches of engineering had reached a high state of perfection. Civil engineering, for instance, has been practiced for centuries, and, in fact, there has been little change in this branch of the art during the past 25 or 30 years.

History tells us that George Washington was a civil engineer of no mean repute. Back in the time of the ancient Romans many branches of civil engineering had reached a high degree of perfection, as witnessed by the wonderful roads constructed by Caesar, many of which are still in existence and were used daily by the allied armies in France.

Another and a really remarkable example of ancient engineering is to be found in the aqueduct system in and about the city of Rome.

3. *Definitions of word "engineer."*—Modern engineering is essentially a product of the 20th century. In this connection it is interesting to know the real significance of the term "engineering" as given in the Standard Dictionary. The verb "engineer" is defined as follows:

1. To put through or arrange skillfully or by contrivance and effort; as, to *engineer* a scheme.

2. To plan and superintend the construction of, etc.

A definition recently developed as a result of conflict arising in government endeavors as to what qualifies an engineer is this:

Engineer: One who economically directs man-power and by scientific design utilizes the forces and materials of nature for the benefit of mankind.

The noun "engineer" is defined as: "One versed in or practising any branch of engineering."

4. *Engineering and the telephone man.*—As previously suggested, it is with the broadest meaning of the term "engineer" that we have to do in the present series of articles. The high cost of telephone materials, especially of wire and cable, renders essential the most careful planning on the part of the telephone manager. Despite the fact that telephone men have been making every possible effort to defer construction work until after the war, nevertheless, to maintain a high standard of service, it is necessary to carefully maintain the outside and inside telephone plant and to do a certain amount of new construction work.

Time and thought spent in preparation of maintenance and construction plans may obviate unnecessary expenditures, and it is the purpose of this series of articles to set forth the principles of telephone engineering in such a manner that they may be readily absorbed by the practical telephone man and may aid him in so planning his new construction as to obviate unnecessary expense.

There are numerous reasons why the branch of telephony which has to do with the planning of telephone pole lines, cables, subways, central office and subscribers' station equipment, falls within the province of the engineer rather than in that of the operating executive. Nevertheless, it is possible to outline the fundamentals of telephone engineering in such a way that the executive may to some extent at least solve his own engineering problems.

5. *Lack of engineering in early telephone days.*—In the early days of telephony most telephone executives did their own engineering, frequently without giving the slightest consideration to future plant requirements. Needless to say, such practice resulted either in excessive construction costs, or in an inadequate plant. When a new aerial wire or aerial cable lead was required, the plant manager, or often the construction foreman, would make a rough estimate of the subscribers to be served, paying little or no attention to the ultimate requirements of the territory in question. As a result, the subsequent subscriber growth would often necessitate the addition of cables or arms of wire.

We have all seen the results of "engineering" of this character. Many of the older plants still show evidence of lack of foresight in planning distribution facilities. One frequently sees five or six cables on a pole line, where one large cable would have sufficed, or, better yet, the entire unsightly overhead structure might have been obviated by the building of several blocks of comparatively inexpensive underground distribution plant.

During the past few years, however, most telephone managers have realized that telephone engineering questions are too complex to be solved by the operating executive unless he has some knowledge of the problems involved in commercial, plant and equipment engineering.

These statements are not intended as a criticism of the practical telephone man who has attempted to do his own engineering. Many telephone men who are excellent managers and good construction supervisors have fallen down completely in their attempts to engineer their properties. This is not due to lack of ability on their part but rather to a lack of a working knowledge of the fundamentals of the highly specialized art of telephone engineering. With that in mind, it is the purpose of this series of articles to set forth the fundamentals of telephone engineering in a manner that will aid business executives and plant managers in acquiring such information as may be required in the solution of their own peculiar problems.

6. *Divisions of telephone engineering.*—Broadly speaking, telephone engineering may be divided into three general subdivisions:

1. Commercial engineering.
2. Outside plant engineering.
3. Equipment engineering.

The correlation of these three divisions of telephone engineering may perhaps be clearer from the consideration of the simple illustration.

7. *Example of commercial engineering.*—About ten years ago a large corporation engaged in the manufacture of aluminum ware, built a plant in a small town located in the East. Previous to that time the town was essentially a farming center with little or no industrial activity. The building of the aluminum plant caused a marked and exceedingly rapid increase in population. Furthermore, indications pointed toward a further growth, due to the attraction of other allied industries.

The company furnishing telephone service to the town and adjoining rural communities, was confronted with a very serious problem. The existing plant was entirely inadequate to handle the increased demand for telephone service and the owners had no way of forecasting the extent of the subscriber growth. Fortunately they had the foresight to employ a competent telephone engineer and they instructed him to make a thorough study of the whole situation and prepare plans for a new plant.

The first task confronting the engineer involved the preparation of a detailed commercial study of the entire community. Men provided with suitable maps were sent out to canvass the city, noting the location of present telephones; the location of vacant houses which would probably be occupied by the industrial workers; and the probable trend of future building development.

The town was divided into small sections and each section analyzed by itself. The locations of all prospective subscribers were noted on the maps and they were classified according to the class of service which from the judgment and experience of the canvassers the various residence sections would justify.

8. *Classification of telephone prospects.*—The men assigned to this portion of the work were carefully coached before hand, by the engineer in charge of the study, as to the proper classification of the various telephone prospects. This classification was accomplished largely on the basis of house rentals.

The engineer in charge of the study analyzed the existing subscriber list and found that subscribers paying $50 a month house rental, or more, were most likely to patronize single-party residence service; those paying between $35 and $50 a month house rental were usually subscribers to two-party telephone service and those under $35 a month, four-party telephone service. The business development was analyzed in a similar manner.

The survey of the entire town for the purpose of determining its telephone propensities required time and patience on the part of the field men. The resulting data, however, proved well worth the effort and, with its aid, the engineer in charge of the study was able to make up a large scale map showing not only the present telephone classification of the company's subscribers, but also a reasonably accurate forecast of the probable future growth and the probable future classifications of service.

9. *Commercial study gives data for plant and equipment engineering.*—A study of this nature is usually termed a commercial study. The one under discussion was made in such a way that it showed the probable subscriber development at the end of a five-year period and also at the end of a 15-year period. The engineer was, therefore, able to make a draft estimate of the facilities required to serve the community for five years from the date of the study and the additional facilities that would be required up to the end of the 15-year period.

With this data he was able to determine the size and type of office equipment and prepare detailed specifications for its purchase. This phase of the problem comes under the head of equipment engineering.

The data accumulated in the commercial study was used as a basis for the plant engineering. Knowing the location

of the present subscribers and the probable location of the new subscribers during the five and 15-year periods, the engineer was able to lay out an intelligent fundamental plan which could be used as a basis for preparing detailed working plans for the installation of new outside plant.

It is interesting to note that the engineering forecasts made in this particular town have proved to be remarkably accurate, and the original plans for plant construction made in accordance with this forecast have well served the purpose for which they were designed. In making subsequent additions to the central office and outside plant, the fundamental study was used as a guide—making such modifications as seemed necessary to conform with conditions existent at the date of installation.

In a broad way, the engineer in charge of the rehabilitation of the plant under discussion fulfilled the function of commercial engineer, equipment engineer and plant engineer. He first made a commercial study and then used this study as a basis for his plans for reconstructing the outside plant and central office equipment.

In following installments of this series of articles more detailed consideration will be given to each of the three phases of telephone engineering briefly touched upon here.

(To be continued.)

Convention of American Wood-Preservers' Association.

The American Wood-Preservers' Association will hold its 15th annual meeting at Hotel Statler, in St. Louis, Mo., January 28 and 29. This convention will be given over to a consideration of the problems and changes in the wood-preserving industry due to the war.

The disorganization of ocean shipping has curtailed the supply of creosote and forced the substitution of other preservatives. Uniform specifications and centralized purchasing of cross ties have made necessary radical adjustments in the industry.

Interstate Commerce Commission Telephone Statistics.

The Interstate Commerce Commission has just issued its summary of the reports of revenues and expenditures of 61 Class A companies, filed with the bureau of statistics, for the month of July and the seven months ending with July, and it is given in full in the accompanying table. The gross revenues for the month were $29,693,784, an increase of 11.9 per cent over the same month in 1917. The expenses totaled $21,818,920, an increase of 15.7 per cent. The net operating revenues, $7,874,864, showed an increase of 2.6 per cent, but the operating income, $5,650,674, showed a decrease of .8 per cent. The operating expenses comprise 73 per cent of the operating revenues as compared with 71 per cent in July, 1917.

For the seven months ending with July the gross revenues were $196,103,666, an increase of 7.4 per cent. The expenses were $137,013,847, an increase of 10.9 per cent. This left a net operating revenue of $59,089,819, which showed a decrease of less than one-tenth of one per cent. The operating income for that period, $44,733,953, showed a decrease of 4.4 per cent.

Self-Forgetfulness and Devotion to Duty of Operators.

The Independence Free Press of Independence, Kans., recently "cited for bravery" Miss Nellie Frost, operator of the Home Telephone Co. When the "flu" was spreading throughout the city and countryside, when the calls for doctors and nurses reached an unprecedented peak, one of the most loyal girls in the central office swooned from exhaustion and fell unconscious to the floor.

The operator was hastened to her home and placed under medical care. But as Miss Frost realized the supreme need of her services to the public, she returned to her place at the switchboard against the advice of her physician and despite the pleadings of her friends.

The public will never realize the debt of gratitude it owes to the heroine at the switchboard, and we may safely say her number is legion.

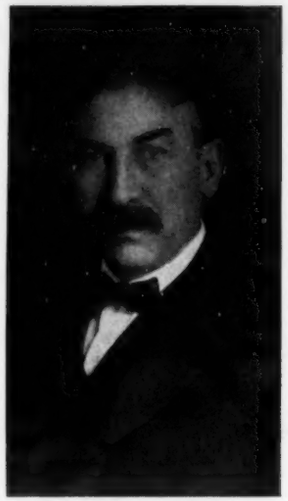
Item.	For the month of July. 1918	1917	Increase (or decrease) Amount.	Ratio per cent.	For the seven months ending with July. 1918	1917	Increase (or decrease) Amount.	Ratio per cent.
Number of company stations in service at end of month.....	7,918,432	7,585,337	333,095	4.4	.....	.....	.....	....
Revenues:								
Subscribers' station revenues.....	$18,910,417	$17,218,281	$1,692,136	9.8	$125,671,127	$118,960,451	$6,710,676	5.6
Public pay station revenues.....	1,650,056	1,300,247	349,809	26.9	10,514,122	9,583,719	930,403	9.7
Miscellaneous exchange service revenues	315,329	273,072	42,257	15.4	2,059,095	1,855,013	204,082	11.0
Message tolls	7,623,625	6,800,857	822,768	12.1	50,619,999	45,992,919	4,627,080	10.1
Miscellaneous toll line revenues..	794,045	639,371	154,674	24.2	4,931,803	4,330,147	601,656	13.9
Sundry miscellaneous revenues..	395,683	294,290	101,393	34.5	2,287,586	1,902,854	384,732	20.2
Licensee revenue—Cr.....	1,077,368	1,010,796	66,572	6.6	7,315,737	6,880,404	435,333	6.3
License revenue—Dr.....	1,072,739	1,009,334	63,405	6.3	7,295,803	6,865,376	430,427	6.3
Telephone operating revenues.....	29,693,784	26,527,580	3,166,204	11.9	196,103,666	182,640,131	13,463,535	7.4
Expenses:								
Depreciation of plant and equipment	4,262,172	4,831,337	†569,165	†11.8	29,464,894	32,845,668	†3,380,774	†10.3
All other maintenance.....	4,957,687	3,937,110	1,020,577	25.9	28,589,787	24,948,848	3,640,939	14.6
Traffic expenses	8,117,446	6,207,937	1,909,509	30.8	50,394,900	39,490,133	10,904,767	27.6
Commercial expenses	2,950,038	2,546,918	403,120	15.8	19,104,074	17,579,104	1,524,970	8.7
General and miscellaneous expenses	1,531,577	1,326,888	204,689	15.4	9,460,192	8,674,211	785,981	9.1
Telephone operating expenses.....	21,818,920	18,850,190	2,968,730	15.7	137,013,847	123,537,964	13,475,883	10.9
Net telephone operating revenues..	7,874,864	7,677,390	197,474	2.6	59,089,819	59,102,167	†12,348	(X)
Other operating revenues	1,857	1,250	607	48.6	11,028	8,756	2,272	25.9
Other operating expenses.....	1,519	1,373	146	10.6	13,782	9,042	4,740	52.4
Uncollectible operating revenues....	113,785	132,373	†18,588	†14.0	875,560	895,229	†19,669	†2.2
Operating income before deducting taxes	7,761,417	7,544,894	216,523	2.9	58,211,505	58,206,652	4,853	(X)
Taxes assignable to operations.....	2,110,743	1,846,779	263,964	14.3	13,477,552	11,402,906	2,074,646	18.2
Operating income	5,650,674	5,698,115	†47,441	†.8	44,733,953	46,803,746	†2,069,793	†4.4

†Decrease.

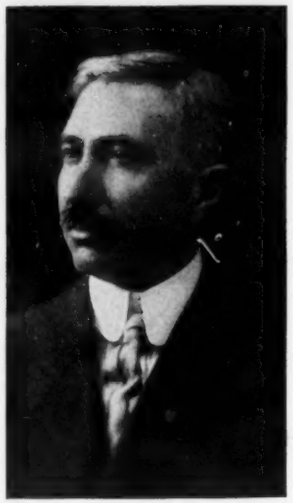
NOTE: Figures for the two years are only roughly comparable owing to a more accurate separation of July and August revenues and expenses in 1918 than in 1917.

(X) Less than one-tenth of one per cent.

Interstate Commerce Commission Summary of Reports of Class A Telephone Companies for July.



W. G. Brorein, of Tampa, Florida District.



Hart F. Farwell, of Terre Haute, Southern Indiana District.

F. B. MacKinnon, Chairman, Independent Group, has been vice-president of the United States Independent Telephone Association since its formation in 1915.

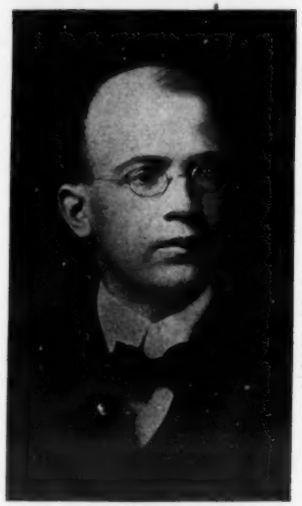
For 11 years Mr. MacKinnon was active in Kansas Independent telephone affairs, in the operating field and

later as secretary of the Kansas Independent Telephone Association, devoted all of his time to its interests.

Mr. MacKinnon has been a potent factor for good in promoting Independent telephone interests in Washington for the past four years. His ability as a wise leader has been proven in the events of recent months.

W. F. Goodrich, of La Crosse, Wisconsin District.

E. C. Blomeyer, of Waco, Texas District.



Charles E. Tarte, of Grand Rapids, Michigan District.

J. C. Duncan, of Knoxville, East Tennessee District.

Chas. A. Rolfe, of Redlands, California District.

L. E. Hurtz, of Lincoln, Nebraska District.

District Chairmen Appointed by F. B. MacKinnon, Chairman of the Independent Group of Telephone Companies Under Federal Control, to Assist in Carrying Out a Systematic Method of Dealing with Independent Companies to the End That the Very Best Service May Be Given the Public, the Property Interests Safeguarded, and the Announced Policy of the Postmaster General Relative to Good Service, Economies, the Employment of Standard Methods, and Unification May Be Put Into Effective Operation at the Earliest Possible Moment.

W. P. Hawley, of Bluefield, West Virginia District.

Geo. W. Robinson, of St. Paul, Minnesota and North Dakota District.

E. D. Schade, of Johnstown, Pennsylvania District.

H. L. Beyer, of Grinnell, Iowa District.

E. D. Glandon, of Pittsfield, Northern Illinois District.

Walter J. Uhl, of Logansport, Northern Indiana District.

R. L. Stewart, of Atlanta, Georgia and South Carolina District.

Geo. R. Fuller, of Rochester, N. Y., Rochester District.

Telegraph and Telephone Service Order No. 2535.

Washington, December 23, 1918.

Order No. 2536 appointing David J. Lewis, chairman, Harry B. Thayer, vice-president, American Telephone & Telegraph Co., Charles Y. McVey, president, Ohio State Telephone Co., Paul B. Haynes, Indiana Public Service Commission, and Noah W. Simpson, Missouri Public Service Commission, a committee to make the necessary studies and recommendations to the Postmaster General with a view to standardizing the rate schedules of telephone service throughout the United States, is hereby amended by the appointment of Professor A. N. Holcombe, of Harvard University and the United States Bureau of Efficiency, to take the place of Paul B. Haynes, of the Indiana Public Service Commission, who is unable to serve.

A. S. BURLESON, Postmaster General.

Senate Resolution for Inquiry on Wire Control.

Urging that the government must provide legislation for future control of the telephone, telegraph, and cable systems, Senator Kellogg of Minnesota on January 2 offered a resolution to direct the Interstate Commerce Commission to make an inquiry into the whole subject. In his resolution Senator Kellogg called for an investigation of these points:

1. Assumption by the government of the supervision, possession, control, or operation of any or all of the telegraph, telephone, marine cable, and radio systems.

2. The future ownership, supervision, possession, control, or operation of any or all of said systems by the government.

3. The condition under and the extent to which any or all of said systems should be permitted to consolidate and authority therefor.

4. Effect of the Sherman act upon the consolidation of marine cable systems extending to foreign countries and the advisability of modifying said act.

5. Necessity for the extension of the marine cable systems to foreign countries and the effect thereof upon the commerce of the United States.

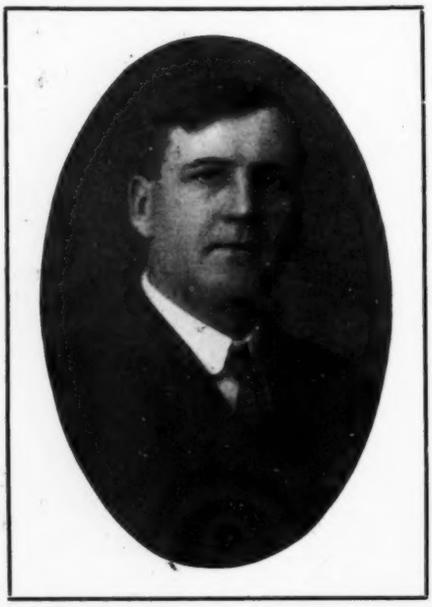
6. The sufficiency of the telegraph, telephone, marine cable, radio systems to meet the business requirements of the United States.

7. All other subjects pertinent to the general subject of private ownership, supervision, possession, control, and operation of any or all telegraph, telephone, marine cable, and radio systems.

"I think the time has come for some real conservative legislation on these facilities," said Senator Kellogg. "I seek to have Congress informed as to what is necessary for this extension, development, and best means of operation.

"I am not particularly interested in why these lines were taken over; they have been taken over and we should approach the subject of the future ownership, control, or operation in a broad-minded business way.

"The extent to which the government should permit the consolidation of telephone, telegraph, and cable systems is a most important question. Manifestly some consolidation under government control would be of advantage to the people. At least the problem should be considered as settled. It is a serious question whether the duplication of telephone lines, especially, is wise, and there are questions about the consolidation of the cable lines which I hope the Senate will develop."



W. G. Bickelhaupt, of Aberdeen, Chairman of South Dakota District.

Third American Army at Coblenz Talks Daily with Berlin.

Daily telephone conversations between Berlin and the headquarters of the Third American army at Coblenz have taken place recently, according to an Associated Press dispatch. The long distance telephone conversations have been in connection with the work of the inter-allied armistice commission and also in arranging details concerning the war material which the Germans are assembling in the region of Coblenz.

All wires between Berlin and the American area of occupation except two were severed December 28, in accordance with the terms of the American occupation decree. The two remaining wires are controlled by the American censors in Coblenz with the army of occupation.

S. M. Heller, of Louisville, Chairman of the Kentucky District.

Chas. Y. McVey, of Columbus, Chairman of Ohio District.

W. N. McAnge, Jr., of Corinth, Miss., West Tennessee-Mississippi District.

Operating Staff for the Bell Lines

Chairman U. N. Bethell of Operating Board of the United States Telegraph & Telephone Administration Announces the Appointment of a Staff of Four Members for Operating the Bell Telephone Lines During Period of Government Control

U. N. Bethell, chairman of the Operating Board of the United States Telegraph & Telephone Administration, on Wednesday, January 8, announced the appointment of a staff for operating the Bell telephone lines under the direction of the Operating Board.

His staff consists of Ben S. Read, of St. Louis, in charge of the rate plans and miscellaneous commercial matters; H. F. Thurber, of New York, in charge of plant and traffic; F. L. Devereaux, of New York, in charge of accounting, statistics, insurance and employes' benefit fund; and C. T. Russell, of New York, in charge of legal matters.

Mr. Read has been second vice-president of the Southwestern Bell Telephone System since May, 1914—a position attained through hard work, before he was forty. He has been in the telephone business all his life, having secured a job as messenger boy in the office of the Cumberland Telephone Co., at Carthage,

H. F. Thurber, in Charge of Plant and Traffic of Bell Lines.

Tenn., 30 years ago, on his 13th birthday, January 21. In time the messenger boy became local manager of the Carthage exchange and was then transferred to the company's general offices at Nashville. More experience as local manager at Owensboro, Ky., Chattanooga, Tenn., and New Orleans followed.

The New Orleans position led to Mr. Read's becoming division superintendent for Mississippi and Louisiana and in March, 1912, he was promoted to St. Louis as general manager of the Bell Telephone Co. of Missouri. In November of that year he was sent to Kansas City as general manager of the Missouri & Kansas Telephone Co. and early in 1914 he returned to St. Louis as operating head of the Southwestern group of Bell companies. Mr. Read's career has been one of hard work and head work.

H. F. Thurber is an electrical engineer and for many years has been operating vice-president of the East Bell Group.

F. L. Devereaux was formerly auditor of the long-distance lines department of the Bell system. During the war he has been a major in the quartermaster general's department.

C. T. Russell, who has charge of the legal matters, is associated with the legal department of the New York Telephone Co.

New Financing Arranged for American T. & T. Co.

The American Telephone & Telegraph Co. has sold an issue of $40,000,000 five-year 6 per cent notes and an issue of $25,000,000 30-year 6 per cent debentures of the New York Telephone Co. to J. P. Morgan & Co., which will head a distributing syndicate of bankers, in which Kidder, Peabody & Co., Kuhn, Loeb & Co., the First National Bank, the National City Company, Harris, Forbes & Co., and Lee, Higginson & Co. will participate.

Theodore N. Vail, president of the American Telephone & Telegraph Co., announced that the five-year notes are issued to refund the indebtedness maturing on February 1, and the New York Telephone debentures are being sold to provide funds to liquidate indebtedness heretofore incurred for the purpose of construction work done on the property of the New York Telephone Co.

No statement was forthcoming as to the price at which the notes and debentures would be issued. An issue of $40,000,000 one-year 6 per cent notes, which the new financing is to pay off, was put out at the first of last year at 99.05. The funded debt of the American Telephone & Telegraph Co. is now about $231,271,000. There is also $40,000,000 in indorsed notes of subsidiary companies.

Butte Capital Controls Interstate Utilities Co. of Spokane.

The Interstate Utilities Co., of Spokane, Wash., operating a telephone system in eastern Washington and northern Idaho, is now controlled by Butte capital. A deal has been consummated

Ben S. Read, in Charge of Rate Plans and Miscellaneous Commercial Matters.

whereby John Maginnis and H. I. Wilson, identified for many years with important interests at Butte, Mont., together with John T. Davies, of Spokane, vice-president and general manager of the company, acquired the stock of Philip Hamlin which amounts to over 90 per cent.

Mr. Maginnis was elected president, Mr. Davies continues in actual charge as vice-president and general manager, Mr. Wilson was made treasurer and A. L. Hatch continues as secretary. Stanley Easton, of Kellogg, Idaho, remains on the board of directors.

Suggestion for Those Writing Letters to Telephone Public.

A recent issue of Telephone Topics sets forth the suggestion that managers, and in fact all employes who have occasion to write to the public, close their letter with the phrase, "Yours for good telephone service" instead of the habitual "Yours truly."

"It certainly is fully as good as 'yours truly,'" says the originator of the idea, "and may be worth a whole lot more."

Commissions, Courts and Councils

Discussions and Rulings of State Bodies Having Supervision Over Telephone Companies — Decisions of Courts in Matters of Interest to Public Utilities and Actions of City Councils Relative to Franchises, Rates and Service

Rate Increases Denied Tri-State & Northwestern Companies.

The applications of the Tri-State Telephone & Telegraph Co. and the Northwestern Telephone Exchange Co. for emergency increases in exchange and toll rates in the state of Minnesota were denied by the Minnesota Railroad & Warehouse Commission in orders handed down December 31.

In both cases the reasons given for denying the increases requested were that the companies had not shown that the increases were needed in order to meet their operating expenses, to prevent impairment of service or destruction of the credit of the companies, nor had they shown that the increases were needed to overcome inroads made by advanced operating costs or diminished patronage and to allow the income no greater than that earned before the war.

The commission takes practically the same position in both cases, though the phraseology of the decisions differs materially.

The commission states in its opinions that the various public utilities commissions of the several states have, during the past year, due to war conditions, granted emergency increases in telephone rates in order to enable the utilities to continue operations and to save them from financial difficulties. The basis upon which these commissions acted and upon which the Minnesota commission believes it is a fair and reasonable basis to act in an emergency situation, is to consider whether or not the return of the telephone company falls within the following propositions:

1. Is an increase in the rates chargeable by the telephone company necessary to cover operating expenses and necessary fixed charges?

2. Is an increase in rates for the war period necessary to prevent a probable impairment of the service and property and the destruction of the credit of the enterprise?

3. Is an increase in rates necessary to overcome inroads made by advanced operating costs or diminished patronage and to allow to the utility an income no greater than that earned by the utility before the war?

These questions, the commission stated, should be considered in view of the further fact that the corporations as well as individuals must bear their share of the burdens of the war and sustain some loss of income without flinching.

The exhibits of the Tri-State company showed a return upon the investment of 8.73 per cent in 1913, 7.86 in 1914, 8.05 in 1915, 6.29 in 1916, 5.63 in 1917 and 5.63 for 1918, based upon the first six months, making an average for the five-year period of 7.09.

The Northwestern exhibits showed a return of 8.88 per cent in 1913, 9.38 in 1914, 10 in 1915, 10.1 in 1916, 8.45 in 1917 and 7.46 for the first six months of 1918 and 7.98 for July, August and September, 1918, or an average since 1913 of 9 per cent.

In considering these cases consideration was taken by the commission that on July 1, 1918, competitive conditions in the state were eliminated by the interchange of properties between the Tri-State and Northwestern companies. This interchange was carried out, subject to the approval of the commission, based upon representation that such a division of territory and elimination of expensive competition, would tend to reduce the expense to the companies and aid them during the stress of war period.

The first three months following this change the net return of the Tri-State company was 7.23 per cent, being higher than the company had received at any time since 1915. During this period the Northwestern company's accounts showed a return of 7.98 per cent, which is a slight increase over 1917 and the first six months of 1918.

Both companies contended that because of present labor conditions and the demand of employes for increases in their wage schedules, it was essential that they have additional funds before putting into effect the new wage schedules. The commission was of the opinion that both companies were in position to give their employes the necessary increases in wages and to stand such losses as might occur until such a time as they could show the commission how the increases were reflected in their operating statements. Then the commission would not be acting on hypothetical cases and presumptions of future conditions.

In the Tri-State case, the commission held that it does not feel justified in allowing the company a rate of return in excess of that which it enjoyed prior to the war period. In the case of the Northwestern company, it stated that it does not believe that a decline of a net return from an average of 9 per cent during the past five years to 7.98 per cent, as shown during the months of July, August and September, 1918, is sufficient to show that an emergency exists and that the commission should act without requiring the company to fully prove each item necessary in establishing their needs for additional funds.

Toll Rate Asked to Eliminate Unnecessary Gossip.

With a view to keeping "gossipers" off the lines, the Farmers & Merchants Telephone Co., of Boswell, Ind., recently filed a petition with the Indiana Public Service Commission asking for authority to establish a 10-cent toll rate between Ambia and Boswell.

"This has become necessary to eliminate unnecessary and frivolous use of the said line by gossipers, which has worked unnecessary expense and trouble for legitimate business," is the concluding allegation made in the petition.

Movement for Interchange of Properties in Michigan.

Coincident with the proposal of the Citizens' Telephone Co. and the Michigan State Telephone Co. to raise rates in Michigan, comes an attempt on the part of a number of western Michigan cities to force the two companies to merge their interests or exchange territories so as to eliminate competition. Otherwise, it is declared, there will be organized opposition to the proposal when it comes before the Michigan Railroad Commission some time in January.

The Michigan State proposes to raise its rates on single-line business service from $36 to $54 a year, on two-party lines from $30 to $48, and proposes a new four-party line classification at a rental of $36.50. Residence single-line telephones would be boosted from $18 to $33, and the residence two-party lines from $15 to $27. These increases would affect all exchanges with the exception of Detroit. The Citizens' company has requested permission to raise its rates in similar proportions.

Business men, of Grand Rapids especially, figure they could save money if the telephone companies exchanged territory or otherwise made arrangements to eliminate duplicate service, even though the rates be increased, as the cost of a single line under the proposed rates would be less than the total cost of two lines necessary under the present two-system condition existing in many cities and towns.

The plan of attempting to force the telephone companies to merge in the ter-

ritory in western Michigan was fostered by Attorney P. C. Gilbert, who found much favor for his plan at a recent meeting of city attorneys of western Michigan and others held at Grand Rapids, Mich. Delegations will be sent to Lansing for the hearing on the proposal of the companies to increase rates, and it is believed unless the companies should agree upon some consolidation or merger plan in the various districts, it will be possible to prevail upon the railroad commission to refuse to grant the requested increases.

Hearing in Test Case of Burleson's Authority.

Judge Munger of Nebraska has asked two other federal court judges to sit with him in the hearing of the case brought by the Nebraska State Railway Commission to test the right of Postmaster General Burleson, as head of the national telephone administration, to say what shall be charged for service connections on exchanges in that state.

The Lincoln Telephone & Telegraph Co. is the nominal defendant, but the case was brought asking for a permanent injunction against the collection of the Postmaster General's schedule of charges for the purpose of securing a court decision on the power of the government, under the act of Congress, to fix rates for services wholly within a state.

This is the only case, so far as known, where this jurisdiction and power has been challenged, and it has attracted wide attention from attorneys and state public utility commissions throughout the country, the Nebraska commission having received many letters of inquiry as to the character of the action and urging it to make a finish fight of it.

Members of the commission have been wondering whether Mr. Burleson, in a letter recently sent to Senator Hitchcock of Nebraska, referred to them, when he spoke of "a silly suit recently instituted for publicity purposes in a court known to be without jurisdiction against the Postmaster General." They are of the opinion that he was referring to a suit brought in the east to contest his right to take over the cables.

The case was originally set in the federal court at Lincoln for January 8. It has been continued until January 17 in order to permit attorneys to complete their presentations.

Fine and Imprisonment for Failure to Furnish Service.

The Supreme Court of Minnesota recently sustained Judge Searles in the district court of Washington county in imposing a fine of $50 each on Jake Eder and Max Krause, respectively, president and secretary of the Four Lakes Rural Telephone Co., for failure to furnish service to Henry Sullwold, a farmer residing near St. Elmo, as directed in a mandamus proceeding brought by the attorney general of Minnesota.

The supreme court held that Judge Searles' order was of a dual character. The fine was in vindication of the authority of the court, and is a punishment for a contempt criminal or quasi criminal in character; and the propriety of the court's order could be reviewed upon a writ of certiorari; that the imprisonment feature of the court's order to coerce obedience to the writ and the furnishing of the telephone service was for the benefit of Mr. Sullwold and could not be reviewed by the supreme court except by appeal, and no appeal having been made the supreme court did not pass upon the propriety of the imprisonment.

It therefore approved the fine and quashed the writ of certiorari as to the imprisonment, the effect of which is that the order of Judge Searles in its entirety was not disturbed. The court, however, said in its opinion that there has not been in this case a fine or imprisonment forbidden by section 8355 of the general statutes of Minnesota for 1913.

North Dakota Companies Seek Increase in Telephone Rates.

An increase of 25 per cent in toll rates, and an advance of 10 per cent in local exchange rates, is requested by the Northwestern Telephone Exchange Co., and the North Dakota Independent Telephone Co., of Fargo, in petitions filed with the Railroad Commission on December 12.

In the presentation of the petitions it is contended that present operating costs make the step essential and also that the employes of the company are organized to demand higher pay, and that the organization possesses the power to seriously cripple service by ordering a strike.

New Toll Rates Temporarily Restrained in North Dakota.

The district federal judge at Fargo, N. D., has issued an order temporarily restraining the new toll rates fixed by Postmaster General Burleson. This restraining order was secured on the application of the attorney general and the case will be heard in February.

Tri-State to Lay Rate Matter Before Postmaster General.

Shortly after the Minnesota Railroad & Warehouse Commission handed down its decision denying the application of the Tri-State Telephone & Telegraph Co., of St. Paul, for an emergency increase in exchange and toll rates, George W. Robinson, president of the company, departed for Washington to lay the entire situation before Postmaster General Burleson.

Rate Increase to Telephone Company at Irene, S. D.

The Tri-County Farmers Telephone Co., which serves 155 city subscribers and 427 rural subscribers from its exchange at Irene, is authorized by the South Dakota Railroad Commission, in an order handed down December 24, to increase its rates from $2 for business telephones and $1 for residence and rural stations to $2.25 for business, $1.50 for residence, and $1.55 for rural telephones.

The exchange rates are subject to a 25-cent discount for payment by the 15th of the current month and the rural rates are subject to a discount of 25 cents per month if paid quarterly in advance during the first month of the quarter.

It is also ordered that week-day service be given from 7 a. m. to 10 p. m. instead of 7 a. m. to 9 p. m. as at present, and Sunday and holiday service from 8 a. m. to 12 m. and from 1 to 6 p. m. instead of from 9 a. m. to 11 a. m. and 4 to 6 p. m.

Night service is given to physicians and to other subscribers for emergency calls. Relative to the night service, the manager testified that unless a call was deemed by the company to be an emergency, it was not handled. The commission, however, was of the opinion that it is within the province of the subscriber to determine as to whether a given call is an emergency call.

From the testimony introduced relative to the company's earnings, it was found that the operations for the year 1917 showed a deficit of 1.21 per cent. For the purposes of this case a fair value of $30,000 was placed upon the properties of the company.

The commission was of the opinion that the operating and maintenance cost on rural lines is greater per telephone than on lines within the city and, therefore, authorized a higher rate for rural service than for city residence service.

Texas Supreme Court Ruling on Physical Connection.

The constitutionality of the act of 1907, thirtieth legislature of Texas, providing that telephone companies shall be compelled to make physical connections between their toll lines at common points for the transmission of messages or conversations from one line to another, is sustained by the supreme court in an opinion written by Chief Justice Phillips, and filed December 21.

The opinion was given in the case of Southwestern Telegraph & Telephone Co. vs. the State of Texas et al., from Childress county, and the order is made affirming the judgment of the district court and the court of civil appeals.

There is a proviso in the act that in no case shall a telephone company be compelled to receive from the line of another company and transmit to its final destina-

tion any message originating in its own line. Where an incorporated city is a common point of two such lines the act authorizes a public hearing by the city council for the purpose of determining whether in the interest of the public convenience it is necessary for such a connection to be made and to order it made if found to be necessary, upon such conditions and division of expense as the council shall provide. Provision is made for an appeal from such order by any line thus affected by it to the court of proper jurisdiction.

Schedule of Commission Hearings and Summary of Rulings.

ILLINOIS:

December: Petition filed by the Kinloch-Bloomington Telephone Co. and the Central Union Telephone Co. for the approval of the sale by the former to the latter of its telephone properties in Bloomington.

January 7: Hearing at Springfield in the matter of the petition of the Mississippi Valley Telephone Co. for permission to disconnect its toll line from Macomb, now connected with the Macomb Telephone Co. from the exchange in Colchester and from the Farmers Switchboard Co. at Plymouth, also from certain lines in the village of Augusta, unless satisfactory arrangements can be made, also to disconnect two or three rural lines from the switchboard at Plymouth, etc. No. 8001.

January 7: Hearing at Springfield in the matter of the complaint filed by the Peoples Mutual Telephone Co. relative to the invasion by the Coles County Telephone Co. into the territory of the complainant in the vicinity of Diona.

January 7: Hearing at Springfield in the matter of the application of the Mississippi Valley Telephone Co. to discontinue certain free service and establish toll rates at certain points in Hancock county, as follows: Carthage, Burnside, Sutter, Basco and Dallas City exchanges.

January 7: Hearing at Springfield in the matter of the application of the Mississippi Valley Telephone Co. for authority to remove discriminations in rates and fix new rates for telephone service, fix new switching rates and discontinue certain free service and establish toll rates at certain points in Hancock and Adams counties. No. 8756.

January 7: Hearing at Springfield in the matter of the proposed advance in rates for telephone service at Minier, Mackinaw and Stanford by the Minier Mutual Telephone Co. No. 8763.

January 8: Hearing at Springfield in the matter of the complaint by the Fayette Home Telephone Co. of the invasion of its territory in Loogootee and vicinity by the St. James Rural Telephone Co.

January 9: Hearing at Springfield in the matter of the application of the Farmers & Merchants Telephone Co. for authority to increase its telephone rates 25 cents per month, the increase to be discounted if payment is made on or before the 15th of the month for which service is rendered. No. 8793.

January 9: Hearing at Springfield in the matter of the joint application of the Porterville Telephone Co. and the Annapolis Telephone Exchange for the approval of the purchase by the former and sale by the latter of its telephone property at Annapolis. No. 8801.

INDIANA.

December: Petition filed by the Farmers & Merchants Telephone Co., of Boswell, for authority to establish a 10-cent toll rate between Ambia and Boswell.

MICHIGAN.

January 7: Petition filed by the Michigan State Telephone Co. for permission to equalize rates on its 189 exchanges in Michigan outside of Detroit. The company has divided its companies into six groups, according to size and conditions, with different schedules for each group.

MINNESOTA.

December 31: The commission denied the applications of the Tri-State Telephone & Telegraph Co. and the Northwestern Telephone Exchange Co. for emergency increases in exchange and toll rates in the state, it being the opinion of the commission that the companies had failed to show that such an emergency exists.

NEBRASKA.

December 30: Application filed by the Monroe Independent Telephone Co. for permission to increase rates at its Genoa, Monroe, Platte Center, Lindsay, Tarnov and Newman Grove exchanges.

December 30: Complaint of Fred Patterson, of Shickley, that the Lincoln Telephone & Telegraph Co. has increased its switching charges without authorization by the commission, filed.

December 31: Complaint of National Supply Co. against Nebraska Telephone company that latter is giving it unsatisfactory toll service at Omaha, filed.

December 31: Complaint filed by William Pickerill against the Lincoln Telephone & Telegraph Co. that it is seeking to collect increased switching charges at Unadilla without having first secured permission from the commission.

January 2: Nebraska Telephone Co. notified commission that it would not appear before it on January 4 as ordered, for the purpose of showing cause why it had not furnished service to D. C. May, of Broken Bow, it having complied with the commission order to supply such service. The company explained that it had not done so when first ordered as at that time the cost of the new construction required exceeded the limit permitted by the national administration; that since then the limit had been removed and an order for the service issued December 19.

January 3: Application of Firth Telephone Co. for permission to sell a part of one of its farm lines to a group of farmers who desire to connect with Cortland company exchange, filed.

January 3: In the matter of the application of the Wyoming & Nebraska Telephone Co. for permission to increase toll rates 25 per cent. granted. The company's request for a flat percentage increase of exchange rentals is denied on the ground that this would result in awkward rates, but higher rates are authorized each of its exchanges at Chadron, Crawford, Belmont, Gordon, Rushville, Crookston, Cody, Whitney, Valentine, Harrison, with discounts for advance payments.

January 3: Frontier Telephone Co., of Hubbell, by President Wilcox, appears in answer to order to show cause why a telephone has not been installed in Mrs. Wilcox's home; company agrees to obey order.

NEW YORK.

December 26: Petition filed by the Granville Telephone Co., of Granville, for an increase in rates.

OREGON.

December 23: Hearing at Albany on the application of the Home Telephone Co. to increase its rates in Albany and Corvallis.

SOUTH DAKOTA.

December 24: The commission granted an increase in rates to the Tri-County Farmers Telephone Co., of Irene, S. D.

Sundry Snapshots Along the Trail

Observations and Comments, Pertinent and Otherwise, On the Sunshine and Shadows of Telephone Work

By Well Clay

When Grandma used to make a cake,
She never stopped to look
How much to take of different things,
From any old cookbook.
She only rolled her sleeves up high,
And greased a dish or so;
Then mixed some milk and eggs and stuff,
Which was to make the dough.
She stirred this mixture round and round,
Then threw some seasoning in;
Cup of raisins, then some spice,
And dumped it in a tin.

I remember when she scraped the dish,
It seemed just like a tune;
And when the cake was in the oven
She let me lick the spoon.
She never watched the clock to see
How long the baking took,
And somehow always hit it right
Without looking at a book.
When the oven door was opened,
It was a bully sight,
And a whiff of incense told me
That it was "done" just right.
Nowadays they weigh and measure,
Using neither less nor more,
And there's even a thermometer
Upon the oven door.
They bake it as per schedule,
So many minutes by the clock,
But it don't smell nor taste like Grandma's—
Not that I like to knock.

You will all remember in the good old days before substitutes were your main stay as to grub, how delicious the smell was that used to come out of the old home kitchen on baking days, and how

good the crisp, hot doughnuts were after you had been out sliding downhill or skating all forenoon and came in with an appetite that would be worth money to you now.

There was plenty in those days and a substitute for any of the common articles of food was never dreamed of. With butter and pork and beans and flour so cheap, what was the use to find anything to take their places as a substitute? Weren't the real things good enough without going to the trouble of getting something else Sure! But those days are gone and with them are gone many of the things from our reach that we used to think were so cheap and plentiful and worthless.

In place of those days have come times when we must begin to measure and weigh, and be careful. Our resources in the telephone game have in a like manner undergone a change. Now in place of cheap poles and wire and labor, we have a real scarcity of the former and high prices to pay for the latter. No longer do we cut up perfectly good 25-foot poles to make slugs because it would not pay to stop and look around for a substitute. No longer do we throw away a snarled coil of wire to save the little time it would take to untangle it. We are beginning to take heed and to look ahead a little.

When I first came to the place where I now reside, one of the most common sights to be seen on the streets of the town, was ox teams, drawing loads of cordwood which the driver was trying to find a market for at one dollar and a half a cord or maybe two dollars, if it were dry oak or maple. The real financiers of the town used to wait until along towards dark and then go down the street and buy a load for a dollar, or even 75 cents, if they found some which had not found a buyer that late. The farmer would sacrifice rather than to haul so worthless a commodity back to the farm.

It is different now, and when one wants to indulge in a whole cord of wood, he must take a check book in hand and go early. It will cost him, when he can find a load for sale, all the way from twelve to fifteen dollars, and then the thrifty farmer has helped to conserve the fast-diminishing supply by cutting it only three feet and a half long, probably.

Looking these facts squarely in the face, what do we see that they portend as to our future actions in the telephone field? We know that from now on, no matter how ends the government experiment, there must be radical changes if we are to stay in the field. We will not only be governmentally-supervised but will be economically forced to make changes that will not only tend to conserve our rapidly-diminishing supply of poles and cross arms, but we will have to begin to look ahead and prepare to do without wood entirely, it seems to me, in at least these two items, if telephone rates are to be kept within reasonable bounds.

The need of any new things always finds the new product ready, or at least in a formative stage of development, and we may look, in the near future, for the recently-released output of our new steel mills to furnish us with these articles, unless there is so radical a change as to do away with them altogether, which does not at this time seem probable. The question of whether we are to be allowed to occupy, indefinitely, valuable ground on public highways or on private fields for clumsy pole lines and their attendant guying attachments, will soon come up. The chances are that, at least in many sections of the country, the overhead will have to go, as well as in most cities.

This being the case, it will be well to look very carefully into the matter of replacing expensive pole lines until we are sure there is no alternative in the way of cheaper underground construction possible, which will answer the purpose and be of a permanent enough nature so that depreciation will be moderate.

In the days just ahead of us, there looms the probability of great activity in the airship business. The manufacture of large numbers of these will be a continual tax on the supply of fir which is left, so that cross-arm manufacturers will have to look elsewhere for material as the manufacturers of airships will naturally pay a higher price on competitive bids than the profitable manufacture of cross arms will allow. Thus they will get the material to the exclusion of the cross arm manufacturer.

The question of insulation will be another, if the supply of crude rubber is not speedily augmented by something new in the substitute line, for the airplane will soon make the most distant gum forests readily accessible and, therefore, soon exhausted, with all the drains in the motor car line which it has to supply in the way of tires.

The insulation question is one thing that stands in the way of more universal underground work, else it would be a simple matter to lay iron wire cables underground across country 'most anywhere and take a tap off for each subscriber along a trench, right into his cellar so that most of the troubles of rural lines would be eliminated and storms cease from interrupting service.

It seems to me that in the year just ahead of us will come problems which must be solved that are the equal, for difficulty, of any of the problems which have been solved in the past. They will seem to us like the lessons which are given to the high school seniors in comparison to the ones they had in the first grades. But then, we are all at school and as fast as we learn one set of problems, we are moved up to tackle another and harder set.

That is the logical process of evolution in the telephone game as well as in any other great activity in life, and the reason why. Nature was so good to us in the earlier stages of the game was because we had to have the free gifts to tide us over to that point where their growing scarcity woke us up to the necessity of providing for ourselves. It was the same way with the wild game and the buffalo, else the primitive red man would have perished before he could have figured out the way to erect hot-air furnaces and pancakes and thus enable an existence in a rigorous climate.

APHORISM: Good cooks are always in demand.

Vast Wire System Built in France by U. S. Signal Corps.

In an army the size of the American Expeditionary Force, scattered throughout the length and breadth of France from the seacoast to the Swiss border, the problem of communication is second in, if not of equal, importance to that of supplies.

When the American forces came to France it was one of the first efforts to which American ingenuity and invention was directed and the Signal Corps met it as have the other organizations of the American Expeditionary Forces. Brig.-Gen. E. Russell, chief signal officer, and his staff of experts tackled the job.

The Signal Corps has built approximately 1,750 miles of poles on which it has strung 4,175 miles of wire. In addition about 2,000 miles of American wire have been strung on existing systems for the use of our army and it has leased and operates more than 3,000 miles of French wire. Exchange lines to the extent of 12,750 miles have been built and to operate these lines it has 244 telephone offices, 7,995 telephone stations and 102 telegraph offices.

The long distance telegraph and telephone system constructed by the Signal Corps is entirely maintained by its own personnel and in addition some 3,000 miles of leased wires.

All this construction has been made by Signal Corps battalions with implements and material from the United States with the single exception of poles, most of which were obtained in France. In construction, maintenance and operation the standard practices of the United States have been followed and the American Expeditionary Force has received service equal to the best obtainable in the commercial world and admittedly unrivaled in any army.

The telephone service of the Corps was opened on June 24, 1917, and since then there have been handled nearly 19,000,000 local calls and more than 1,000,000 long distance calls.

"Telephony's" Home Study Course for Telephone Men

A Complete Presentation of the Principles Underlying Modern Telephony in All Its Branches—Arranged Systematically So That Regular Reading and Faithful Study Will Qualify Ambitious Men for Higher Positions—Prepared Under Supervision of Stanley R. Edwards—This Section Written by Jay G. Mitchell

Quiz Questions on the Preceding Installment.

1131. Is there any similarity in the operating function of the private bank contact in the connector switch bank and the test contact in the ordinary manual three-wire common battery multiple? Give the name of a relay which, in ordinary three-wire manual common battery equipment, corresponds, in operating function, to the bridge cut-off relay as shown in Fig. 289.

1132. Is the talking circuit complete from the calling telephone to the called when the wipers of the connector switch have seized the bank contacts of the called line? What effect does the operation of the bridge cut-off relay have upon the continuity of the talking circuit from station to station? How long does bridge cut-off relay, *B*, Fig. 289, remain operated? How is it released? Is the line relay, *C*, connected to the sides of the telephone circuit during conversation? What controls the connection of the line relay, *C*, to the telephone circuit?

1133. What number of line switches are comprised in the ordinary mechanically interlinked set? May more than one set of 25 line switches be placed under the control of one master switch? What happens first in the master switch equipment when a trunk is seized by some one of the line switches under its control? Explain why the master switch bank contacts, *B*, *C*, etc., must be the same in number as the associated trunk circuits. Does the arm *A* and the plate *L* rotate around the same axis?

1134. Why must each contact in the master switch bank correspond to one trunk position in the line switch bank? When does the master switch move all the mechanically-linked line switches away from a seized trunk bank contact position? Does the disconnection of the non-grounded terminal of the common battery from the line switches in the mechanically-linked set prevent the operation of any line-switch plunger while the entire group in which it is found is being shifted to a non-busy trunk position?

1135. How is the "trip relay" assured of being energized when the master switch has reached the limit of its travel and not before?

CHAPTER XXXII, Mechanical Switching (Continued).

1136. *Trip relay operation.*—The path for the flow of current through the winding of the "trip relay" *I*, Fig. 290, is traceable as follows: Starting at the positive or grounded terminal of the common battery, the current passes through the normally-open contact of "starting relay" *D* (now closed), the normally-open mechanically-operated contact *O* (now closed), the winding of trip relay, *I*, the normally-open contact, *H*, of locking magnet *F* (now closed) and the common battery.

This current causes the trip relay, *I*, to attract its armature, *R*. When *R* is operated, it closes its normally-open contacts and is itself mechanically-locked in the operated position through engagement with the locking spring, *J*.

By this simple mechanical expedient, the continued retention of the armature, *R*, of trip relay, *I*, is assured in its operated position after the energizing flow of current through the winding of *I* is interrupted. In other words, the normally-open contacts of trip relay *I* are closed when it is first energized. They are kept closed, after the energizing current is withdrawn, by the mechanical-locking effect of the spring, *J*, on the armature, *R*.

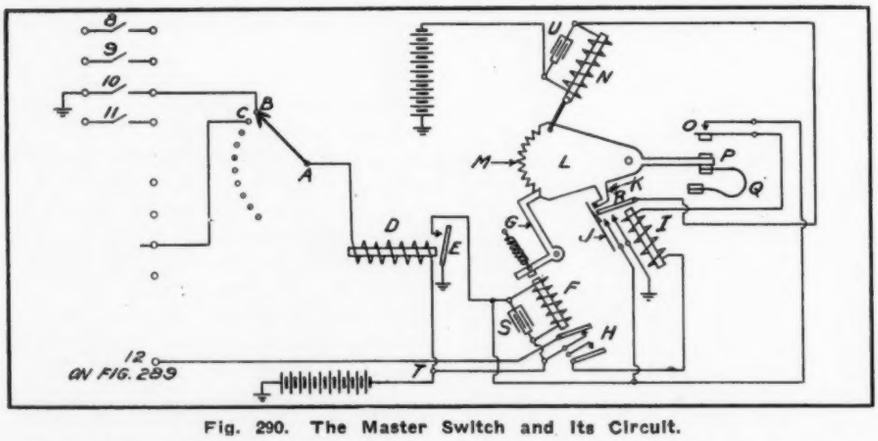


Fig. 290. The Master Switch and Its Circuit.

It is necessary that these contacts be held closed until the master switch has been returned, with the associated line switches, to the starting position. In other words, the master switch will have reached the limit of its travel when trip relay *I* is first energized. As will be seen, the return of the master switch, with the associated line-switch plungers, to the starting point is dependent upon the contacts established by the operation of relay *I*. Therefore, these contacts, once established, must be maintained until the return of the master switch is completed.

When the trip relay, *I*, is operated, one of its normally-open contacts (now closed) completes a path for the continued energization of "locking magnet" *F*. This path is traceable as follows:

Starting at the positive or grounded terminal of the common battery, the current flows through the normally-open contact of armature *R* (now closed), the winding of locking magnet *F*, and the common battery. At the same time, a path is completed for the flow of current through the restoring solenoid, *N*, which is obvious.

1137. *Restoration of master switch to starting point.*—When the master switch, therefore, has passed all its trunk positions and is ready to be returned to the starting position, the locking magnet, *F*, is energized and its armature and the "locking arm," *G*, are held. This releases the plate, *L*, from its engagement with the locking arm, *G*, and permits the plate, *L*, to be swung through the full return arc without other release. At the same time, all the normally-open contacts of trip relay *I* are closed and mechanically held closed.

As a result of the position of the plate, *L*, and the operated position of the armature, *R*, the solenoid, *N*, is energized and draws in its plunger. The movement of the plunger of the restoring solenoid, *N*, swings the plate, *L*, back to the

starting point together with all the associated line-switch plungers that have not been busy. This is the condition shown in Fig. 290, the plate, *L*, and, therefore, all the line-switch plungers, being in the first or starting position in readiness for a trip before the trunk bank contact positions as the calls are received.

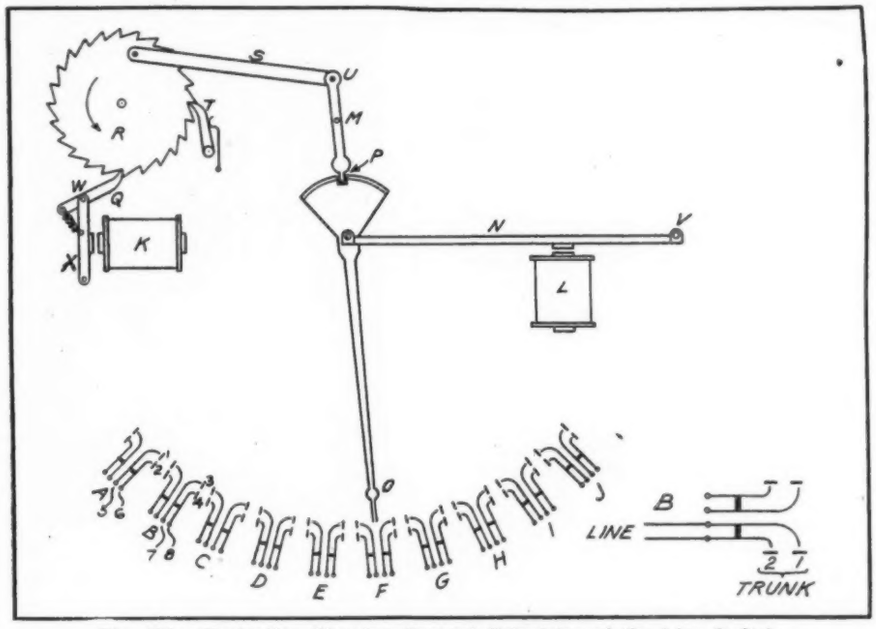


Fig. 281. Illustration Showing General Principles of the Line Switch.

1138. *Release of the trip relay armature.*—When the master switch, with the line-switch plungers, has been thrown back to the starting point by the action of the restoring solenoid, the insulated point, *P*, is withdrawn, by the rotation of the plate, *L*, from the contact springs at *O*.

This contact, which was closed when the master switch had carried the plate, *L*, to the limit of its travel, is now opened again and will remain open until the master switch and line-switch plungers have completed another trip before the bank contact trunk positions. At the same time, the movement of the plate, *L*, to the starting position causes the arm, *K*, to force the locking spring *J* out of engagement with the armature *R*.

When the armature *R* is released, the flow of current through the winding of the locking magnet, *F*, is interrupted. As a result, locking magnet *F* releases locking arm *G*, which re-engages the plate, *L*, in readiness for the subsequent release of plate *L* when the next call is received.

This mechanical lock of the armature, *R*, is necessary because starting relay *D* is released just as soon as the contact arm, *A*, leaves the last bank contact of the master-switch bank on its return to the starting position. Locking magnet *F* and solenoid *N* must continue to be energized, however, until the master switch with plate *L*, contact arm *A* and the associated line-switch plungers, have reached the starting position. It is in order to assure this result that the armature of trip relay *I* is mechanically locked in the operated position with its normally-open contacts held closed after the flow of energizing current has been interrupted at normally-open mechanically-operated contact *O*.

1139. *Operation in making trunk selection.*—Having reached the starting position, as shown schematically in Fig. 290, the master switch will hold all the plungers of the associated set of line switches before the first trunk bank position until one of the line-switch plungers is operated. When this occurs, the master-switch bank contact corresponding to the seized trunk will be connected to the positive or grounded terminal of the common battery, the starting relay, *D*, will be energized, the locking arm, *G*, will be disengaged from the plate, *L*, and the plate with all the remaining disengaged plungers in the set, will move ahead to a position before the next set of trunk bank contacts.

When the master switch again reaches the limit of its travel, restoring-solenoid *N* will be again energized, locking magnet *F* will again hold its armature and the locking arm *G* in the operated position, armature *R* will be mechanically locked in the operated position again and the master switch will be moved back again to its starting position.

As the master switch is moved back to the starting position by the restoring solenoid, *N*, the plungers of all the line switches that have been engaged and are no longer busy, will be picked up by the vertical bar. This bar corresponds to the bar *M* shown in Fig. 281, although it is obvious that the mechanical arrangement shown in Fig. 281 is not the same as the master switch mechanism that has been described. The bar, *M*, in Fig. 281 corresponds, however, to a similar member of the master-switch mechanism as it just has been described.

This member moves with the plate, *L*, Fig. 290, and engages the rear ends of the several line-switch plungers just as the bar, *M*, Fig. 281, would do.

It is worthy of note that should another call be received from a line circuit whose line-switch plunger was out of engagement with the master switch, that no harm would be done. The line switch plunger would be forced into the bank contact position before which it was standing. This trunk could not be busy on another call because no line-switch plunger had been poised before it since it was seized by the plunger now re-occupying it.

(To be continued.)

Some Comparisons Showing Effect of New Toll Rates.

The new toll rate schedule recently ordered by Postmaster General Burleson has excited comment in Minnesota, as in several other states. The railroad commission recently gave out a statement showing a comparative list of the toll rates between the Twin Cities and various Minnesota points. In some respects this list was incorrect and President Geo. W. Robinson, of the Tri-State Telephone & Telegraph Co., has made up a comparative list covering about the same towns as given in the statement issued by the railroad commission.

It will be noted that the statement of Mr. Robinson which follows, gives the present rates based on a three-minute schedule practically the same as the proposed rates which become effective January 21:

Twin Cities to—	Present rates, basis 1 minute conversation.	Present rates, basis 3 minutes conversation.	Proposed rates, station to station basis 3-minute conversation.	Proposed rates, person to person basis 3-minute conversation.
Aitkin	40—1—25	$0.90	$0.80	$1.00
Albert Lea	35—1—20	.75	.65	.80
Alexandria	45—1—30	1.05	.85	1.05
Austin	35—1—20	.75	.65	.80
Bemidji	65—1—50	1.65	1.30	1.60
Brainerd	40—1—25	.90	.75	.90
Crookston	80—1—65	2.10	1.70	2.10
Detroit	60—1—45	1.50	1.25	1.55
Duluth*	40—3—10	.40	.95	1.15
Fergus Falls	55—1—40	1.35	1.15	1.40
Glencoe	25—1—15	.55	.40	.50
Hutchinson	25—1—15	.55	.45	.55
Litchfield	30—1—20	.70	.50	.60
Little Falls	35—1—20	.75	.65	.80
Luverne	60—1—45	1.50	1.15	1.40
Mankato	25—1—15	.55	.50	.60
Marshall	45—1—30	1.05	.90	1.10
Owatonna	25—1—15	.55	.45	.55
Pipestone	55—1—40	1.35	1.15	1.40
Rochester	30—1—20	.70	.55	.65
St. Cloud	25—1—15	.55	.50	.60
Sauk Center	40—1—25	.90	.70	.85
Thief River Falls	80—1—65	2.10	1.75	2.15
Virginia†	45—1—35	1.15	1.20	1.50
Winona	40—1—25	.90	.70	.85

*Initial period for Duluth is now 3 minutes. †Present Virginia rates are based on Duluth rate.

Biographical and Personal Notes

Charles E. Sudmall, general manager of the Gulf Telephone & Telegraph Co., at Milton, Fla., is a Russian by birth but adopted this as his country many years ago. He has been engaged in the telephone business in Milton for 13 years. His company serves about 200 subscribers and has a very profitable toll business.

Prior to entering the telephone field Mr. Sudmall was in the government employ at the Pensacola navy yard in the general electrical department. He is a member of the Florida Telephone Association.

C. E. Sudmall, General Manager, Gulf Telephone & Telegraph Co., Milton, Fla.

Mr. Sudmall, above all things, is conservative. He'll map out a plan but before putting it through will be pretty certain that it will be successful—no rash, impulsive actions for him. He is practical and has to be convinced of the commercial value of a proposition before entering into or approving it.

Being rather of a modest disposition and not very talkative, Mr. Sudmall keeps many of his ideas to himself and few of his friends know of what he is thinking. Those who know him best say that "still water runs deep" and that he is a good business man with an excellent understanding of figures. That he is kind-hearted goes without saying among his friends.

"Jerry" E. Carroll, manager of the Mauston Electric Service Co., of Mauston, Wis., during the six years that he has been with the company has succeeded in putting through an increase in rates and placing the company on a paying basis. In addition to operating a telephone system with 700 local battery telephones, he also operates a hydraulic electric plant.

Mr. Carroll entered the telephone business in 1912 as commercial man for the Mauston company, taking complete charge of the plant in July, 1914.

Prior to 1912 he was with the Northwestern Mutual Life Insurance Co., of Milwaukee, for some time. He was born in Lyndon, Wis., October 16, 1891, and received his education in the public schools and the Sacred Heart College at Watertown, Wis.

J. E. Carroll, Manager of the Manston (Wis.) Telephone System.

Mr. Carroll is president of the Commercial Club of Mauston. He is a member of both the Wisconsin State Telephone Association and the United States Independent Telephone Association.

From Factory and Salesroom

Conventions: Minnesota, St. Paul, January 21-23: Ohio, Columbus, February 5-6

New and Improved Types of P. B. X. Switchboards.

Within the course of the next few weeks the Stromberg-Carlson Telephone Mfg. Co. will begin to advertise and sell two new and improved types of private branch exchange switchboards, the preliminary models of which were exhibited at the last national telephone convention. These new switchboards are said to contain a number of unique features which hitherto have never been incorporated in any other type of telephone switchboard equipment.

The development of these switchboards was brought about by a study of thousands of P. B. X. switchboard specifications which are on file in the company's engineering department. It was found that the large majority of the requirements for equipment of this class could have been met satisfactorily by one or two standard types of cabinets with one general type of circuit equipment. As a result, the new switchboards have been designed to possess a wide range of service flexibility so as to meet various local operating conditions.

Two sizes of cabinets will be furnished —No. 101, which has an ultimate capacity for 50 P. B. X. lines, 8 pairs of connecting cords and 5 main exchange trunk, and the No. 102, which has an ultimate capacity for 100 P. B. X. lines, 10 pairs of connecting cords and 7 main exchange trunks. These cabinets will be carried in stock with several standard equipments, so that shipments can be made promptly upon receipt of orders. Since these switchboards are engineered and built in large numbers, the costs of engineering per switchboard are very small and much of the economic waste caused by building switchboards "to order" is avoided.

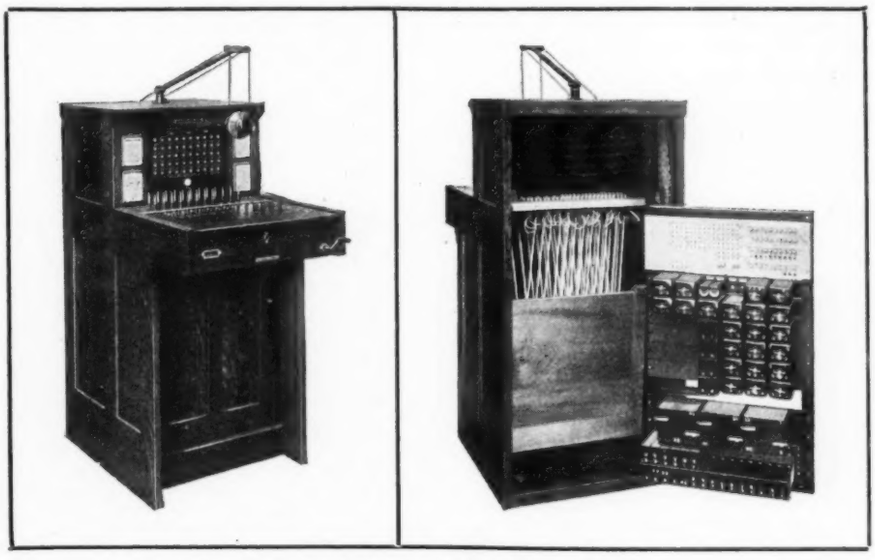
Both switchboards are wired and equipped for operation from a 20-volt storage battery located on the subscriber's premises or from current of equal potential furnished from the main exchange battery over cable pairs. The line trunk and supervising signals are of the lamp type and are fitted with unbreakable lamp caps, without guards, so as to give signals of maximum brilliancy and prominence.

It will be noted from the rear views of the cabinets that the relays, condensers, terminals, etc., associated with the various circuits, are mounted on a side-swinging iron frame so that inspectors may work on either side of the frame and make adjustments and tests without interfering with the operator.

One of the most striking features of these switchboards is the type of trunk circuit employed. It is a plug-ended trunk fitted with a white incoming call lamp, a red supervisory lamp, and a green "hold" lamp. The functions of the white and red lamps are the same as in other trunks of this nature; the innovation is

the green hold lamp. This lamp is illuminated and remains lighted as long as the trunk is held by any act of the operator.

The green lamp lights when the listening key is operated and remains lighted to show that the trunk is being held and until the called P. B. X. party responds. This signal is also displayed when the P. B. X. party hangs up if the operator has left her listening key open. The benefits derived from this extra signal are an increased supervision over trunk calls and a reduction of the trunk holding time.



The New No. 101 Stromberg-Carlson 50-Line Capacity P. B. X.

Another distinctive feature is the method of mounting all of the relays, condensers, etc., for each trunk on an individual removable trunk circuit apparatus plate. These plates are fitted with screw terminal lugs which connect with similar lugs on the switchboard interior cabling so that any plate may be removed intact as a unit without soldering and without disturbing the other trunks.

Two types of trunk circuit plates are furnished, one an impedance coil type of trunk for systems near the central office, wherein battery is supplied from the main exchange, and the other a repeating coil type of trunk which is used for outlying P. B. X.'s, which have a battery installed in connection with the local system.

The two types of circuit plates are interchangeable in both types of switchboards without change in the rest of the trunk circuit wiring. It follows that this permits a telephone company to change any board of this type from main exchange battery supply to local storage battery supply by simply a change in the circuit plates.

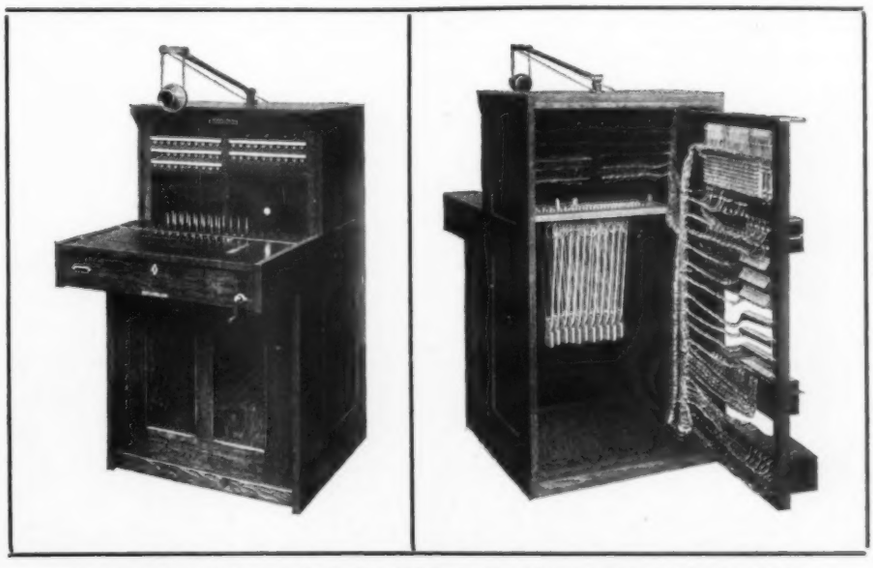
The switchboards are normally furnished for operation with central energy main exchanges, but the same trunk circuit may be used with magneto and automatic main exchanges by making a slight change in the trunk circuit keys. In this way any switchboard of this type may be used for any class of service.

The idea back of the trunk circuit arrangement and equipment is to provide a standard type of switchboard which can be used in any exchange, under any operating condition, to allow convenient addition of trunk equipments and to centralize the maintenance of the P. B. X. trunk equipment. In this connection it will be noted that any unskilled person in the employ of the telephone company is competent to add or change circuit plate equipments, and that in case of trunk trouble the faulty plate may be replaced and brought into the repair shop where proper working facilities are at hand.

Another excellent feature is the provision made for the use of a P. B. X. ringing converter, which is automatically started in anticipation of the use of ringing current and stopped automatically when the need for ringing current no longer exists.

The circuits and wiring are designed so that the converter is started when the operator throws her listening key when answering an incoming trunk call or whenever she inserts the calling plug of a pair of cords in the jack of a local P. B. X. line. Both of these operations occur just before the need for ringing current, so that the converter is in full operation when either a trunk or cord ringing key is operated. The converter is stopped when the called party responds, or when the operator abandons the calling by taking down the calling cord in the case of cord circuits or by operating her trunk listening key.

A new bulletin which contains complete information on P. B. X. switchboards of this type has been prepared and will be furnished upon application to the advertising department of the Stromberg-Carlson Telephone Mfg. Co., at Rochester, N. Y.



Front and Rear Views of the No. 102 P. B. X. with a Capacity for 100 Lines.

Wire Chief Speaks Highly of Woodpecker Telefault.

In a New Year's letter to W. N. Matthews & Brother, of St. Louis, Mo., Lester Fritz, wire chief for the Jerseyville Telephone Co., of Jerseyville, Ill., compliments the Woodpecker telefault very highly in the following paragraphs:

"About one month ago I was about 50 miles south of East St. Louis. One evening I called upon the manager of the telephone company. His first trouble was that he had a 25-pair cable out for over a week. He could not find a cable man, and he had quite a number of rural lines out, but only one man at work, and he had had no telephone experience.

"Right here I said to him, 'Do you know Matthews Brothers, St. Louis, Mo., make what they call a Matthews Woodpecker

telefault that will locate all of your cable trouble and rural line trouble, even if your man has had no telephone experience? All that he has to know is how to read the directions sent with the instrument.'

The Jerseyville Telephone Co. has been using a Matthews for about five years for locating rural line trouble. They have cut the livery expense one-half, not counting the man's time, which amounts to quite an item these days.

Well, I must quit blowing about this instrument, but I have only started to open up, and if I should open all the way it might raise the price of the instrument, so I shall shut up."

Digging Telephone Pole and Post Holes in Winter.

It isn't much trouble to dig a post hole in warm weather if it is to be put down in fairly soft ground, but in hard soil or in winter when the soil is frozen, a different story is told. That's real work; at least it is for the chap that does not know how to use dynamite for the purpose.

Of course, a bore hole must be put down into which the explosive may be loaded. That isn't always easy unless one has the proper tools. In average hard clay, a long churn drill with a little water does the trick. For harder ground, a heavy steel drive point and sledge are better. A soil auger is useful for finishing the bottoms of deep holes when churn drilling or punching is difficult. Hard shale and rock require the use of rock drills.

In preparing a charge of dynamite for a pole hole blast, a straight, narrow lath, reed, or stick is used which must be as long as the hole is deep. The dynamite cartridges are cut into two or three pieces and at regular intervals, tied to the stick. The blasting cap with length of fuse attached is inserted in the uppermost piece of dynamite. The pieces of dynamite are spaced 6 to 20 ins. apart, depending on the nature of the soil. Two or three test shots will indicate the proper spacing. Aim to use as little dynamite as possible to get the result desired.

The stick with dynamite tied to it is run down the hole, the fuse lighted and the explosive does the rest.

Ordinarily, no tamping is desirable as a narrow hole is wanted and tamping would result in a broader opening, roughly triangular in shape, broadest at the top and narrowest at the bottom.

Ex-Commissioner Now Legal Adviser for Coffey Company.

Judge James L. Clark, ex-commissioner of the Indiana Public Service Commission and present attorney for the Indiana Independent Telephone Association, has been retained by the Coffey System & Audit Co. as legal adviser and to handle the company's rate cases before state public utilities commissions. Beginning January 1, Judge Clark makes his headquarters in the offices of the Coffey company in Indianapolis, Ind.

The Coffey company has been handling a number of cases before the Indiana Public Service Commission and has quite a number to handle before various state commissions during the first quarter of the new year. Judge Clark's experience with the commission will undoubtedly be of invaluable aid in the presentation of telephone rate cases before that and other commissions having jurisdiction over telephone companies.

Paragraphs.

THE NATIONAL TELEPHONE SUPPLY & DEVELOPMENT CO., of Atlanta, Ga., ceased merchandising January 1 and all of its stock is now carried by the Southern Electric Supply Co., of Atlanta.

HARRY W. BIGGS has been appointed general sales manager of the Studebaker Corporation, South Bend, Ind., effective January 1. Since 1909 Mr. Biggs has been an executive of Frank Seaman, Inc., and one of its directors. He began his advertising career with the old Hampton agency, where he was treasurer and later established a business of his own that was absorbed by the Seaman agency. Mr. Biggs has been identified with some of the largest advertising campaigns such as American Tobacco Co., Regal Shoes and Studebaker.

New Advertising Manager of Johns-Manville Co.

Walter Scammon Lockwood has become advertising manager of the Johns-Manville Co., New York. He has been advertising manager of the Toledo Scale Co., Toledo, Ohio, for several years. Mr. Lockwood is well known for his story, "De Luxe Annie," which has been dramatized and has been successful as a play under the same title.

OPPORTUNITIES

(Continued from Page 35)

WIRE YOUR ORDER. LOOK!

100—Common battery Dean wall phones, with or without harmonic ringers, 16, 33, 52, 66 cycles.....$2.50
150—Dean desk sets, complete with bell boxes, main line or 16, 33, 52, 66 cycles $4.50
250—Dean hotel type wall phones, steel cabinet, main line or 16, 33, 52, 66 cycles $3.50
450—Dean local battery 3 bar generator, harmonic or 1000 ohm main line ringers $5.50
1000—Sets Dean and Stromberg harmonic ringers, 16, 33, 52, 66 cycles (less gongs) $1.35
450—Dean extension bells, steel boxes, harmonic ringers, 16, 33, 52, 66 cycles, $1.75
450—Dean main line extension bells, steel boxes $1.25
1000—1 M. F. large condensers.....$0.25
800—Dean bridging type coils for wall phones $0.25
1—Holtzer-Cabot motor generator ringing machine, motor 110 volts, D. C., ringing machine, 16, 33, 52, 66 cycles $200.00

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